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(Box 2) #2954

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J. Lamb / 1034A

Requestor / Document Center (is requested to provide the following document)

Date of request 6/14/96 Expected receipt of document 7/15/96 4/30/

Document number _____ Date of document 1954

Title and author (if document is unnumbered)

Poplar Creek Studies Water & Mud

(This section to be completed by Document Center)

Date request received 6/19/96

Date submitted to ADC 7/3/96

Date submitted to HSA Coordinator 6/19/96

(This section to be completed by HSA Coordinator)

Date submitted to CICO 7/23/96

Date received from CICO 7/29/96

Date submitted to ChemRisk/Shonka and DOE 8/1/96

(This section to be completed by ChemRisk/Shonka Research Associates, Inc.)

Date document received _____

Signature _____

#2954

POPLAR CREEK STUDIES
(WATER AND MUD STUDY)

This document has been approved for release to the public by:

[signature] 7/26/96
Technical Information Officer Date
Oak Ridge K-25 Site

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P OAK RIDGE, TENN.

TO L. C. Emerson
LOCATION Building 9202

ATTENTION

COPY TO G. S. Hill, Bldg. K-1001, K-25
W. H. Baumann
File

DATE June 23, 1954

ANSWERING LETTER DATE

SUBJECT Results of Special Mud and Water Samples from Poplar Creek

On May 4, 1954 special mud and water samples were taken from Poplar Creek at points outside of the Y-12 area and analyzed for total alpha and total beta activity. The location of sampling points and the activity of each sample are shown in the table below:

Sampling Point (Going down stream)	Mud		Water	
	Alpha c/m/g	Beta c/m/g	Alpha c/m/l	Beta c/m/l
At Bridge on Bear Creek Rd.	0.17	120.00	117.0	180.0
At Bridge on Gamble Valley Rd.	86.25	6368.75	100.0	640.0
Near Tennis Courts in W. Vil.	4.37	495.57	83.0	100.0
Near W. -End Service Station	3.27	579.04	133.0	520.0
W. of Sewage Disposal Plant	0.27	82.80	100.0	520.0
At Riding Academy	No Sample	No Sample	33.0	460.0
At Bridge on Turnpike	0.80	216.90	50.0	360.0
At Bridge on Quarry Road	0.55	17.50	67.0	600.0
At Junction of E. and W. Forks	1.27	0.14	33.0	280.0
At Bridge at "Y" Intersection	0.08	6.00	33.0	740.0

of Bear Creek

Signed
Paul C. McRee

Paul C. McRee
Health Physics Department

PCM:mcm

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

0 (3-53)

RESULTS OF EAST FORK WATER SAMPLING OF APRIL 29, 1954

	WATER			MUD		
	Alpha * cts/min/100 ml	** Beta cts/min/100 ml	*** Uranium ppb/100 ml	Alpha cts/min/gram	Beta cts/min/gram	Uranium ppm/gram
1. East Fork at Poplar Creek	6.0	24	0.0	21	273	3
2. East Fork at Quarry Road Bridge	1.9	47	0.0	13	1745	20
3. East Fork at Turnpike Bridge	2.1	63	0.0	31	2106	30
4. East Fork at Riding Academy	2.4	91	0.0	174	33,509	35
5. South Fork at White Wing and Turnpike "Y"	0.4	3	0.0	5.4	436	1.5
6. Bridge at Bear Creek on East Fork	3.7	49	0.5	106	4,038	20
7. Bridge on Gamble Valley Road	4.5	78	8.0	1.0	139,529	40
8. Near tennis courts at West Village	5.0	126	0.0	422	66,656	40
9. Near West End Service Station	4.6	145	0.5	54	6,999	30
10. West of Sewage Disposal Plant near O.R. Golf Course	4.0	73	0.5	171	29,208	40

* At 50% geometry

** At 100% "

6-7-54

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P[redacted] OAK RIDGE, TEN[redacted]

TO Mr. A. F. Becher
LOCATION K 1001 Building

ATTENTION
COPY TO File

DATE July 26, 1954

ANSWERING LETTER DATE

SUBJECT REPORT ON SPECIAL SAMPLING OF EAST FORK CREEK

As a result of a significant increase in the Beta activity found at the mouth of East Fork Creek, a survey of the activity by spot sampling along the stream bed was deemed advisabl The results of the samples taken at intervals between the Y-12 origin of the stream to its confluence with Poplar Creek are shown in the table below:

TABLE I

	Water			Mud		
	Alpha* c/m/100 ml	Beta** c/m/100 ml	Uranium ppb/100 ml	Alpha c/m/gram	Beta c/m/gram	Uraniu pp[redacted]
Bridge at Bear Creek Rd. on East Fork	3.7	49	0.5	106	4,038	20
Bridge on Gamble Valley Road	4.5	78	8.0	1.0	139,529	40
Near tennis courts at West Village	5.0	126	0.0	422	66,656	40
Near West End Service Station	4.6	145	0.5	54	6,999	30
West of Sewage Disposal Plant near O.R. Golf Course	4.0	73	0.5	171	29,208	40
East Fork at Riding Academy	2.4	91	0.0	174	33,509	35
East Fork at Turnpike Bridge	2.1	63	0.0	31	2,106	30
East Fork at Quarry Road Bridge	1.9	47	0.0	13	1,745	20
East Fork at Poplar Creek	6.0	24	0.0	21	273	3
Bear Creek at White Wing and Turnpike "Y"	0.4	3	0.0	5.4	436	1.

* At 50% geometry

** At 100% geometry

The highest activity as shown by the beta activity occurring in the stream bottom mud was found in the upper portion of the stream near the Y-12 installation. Samples were also taken in Bear Creek, but the results indicate that there is no significant contamination contribution from this stream. The uranium concentration in the mud is comparatively low and the calculated beta activity from the uranium present is significantly lower than the actual beta count indicating the source of activity to be material other than the uranium. An investigation at Y-12 did not establish the definite cause of contamination; however, it was concluded that it was fissionable waste material resulting primarily from the uranium "pickling" operation or possibly from cleaning of the cyclotron floor area.

The water and mud samples were analyzed by both the K-25 and Y-12 Counting Laboratories. A comparison of the analyses is shown in Table II.

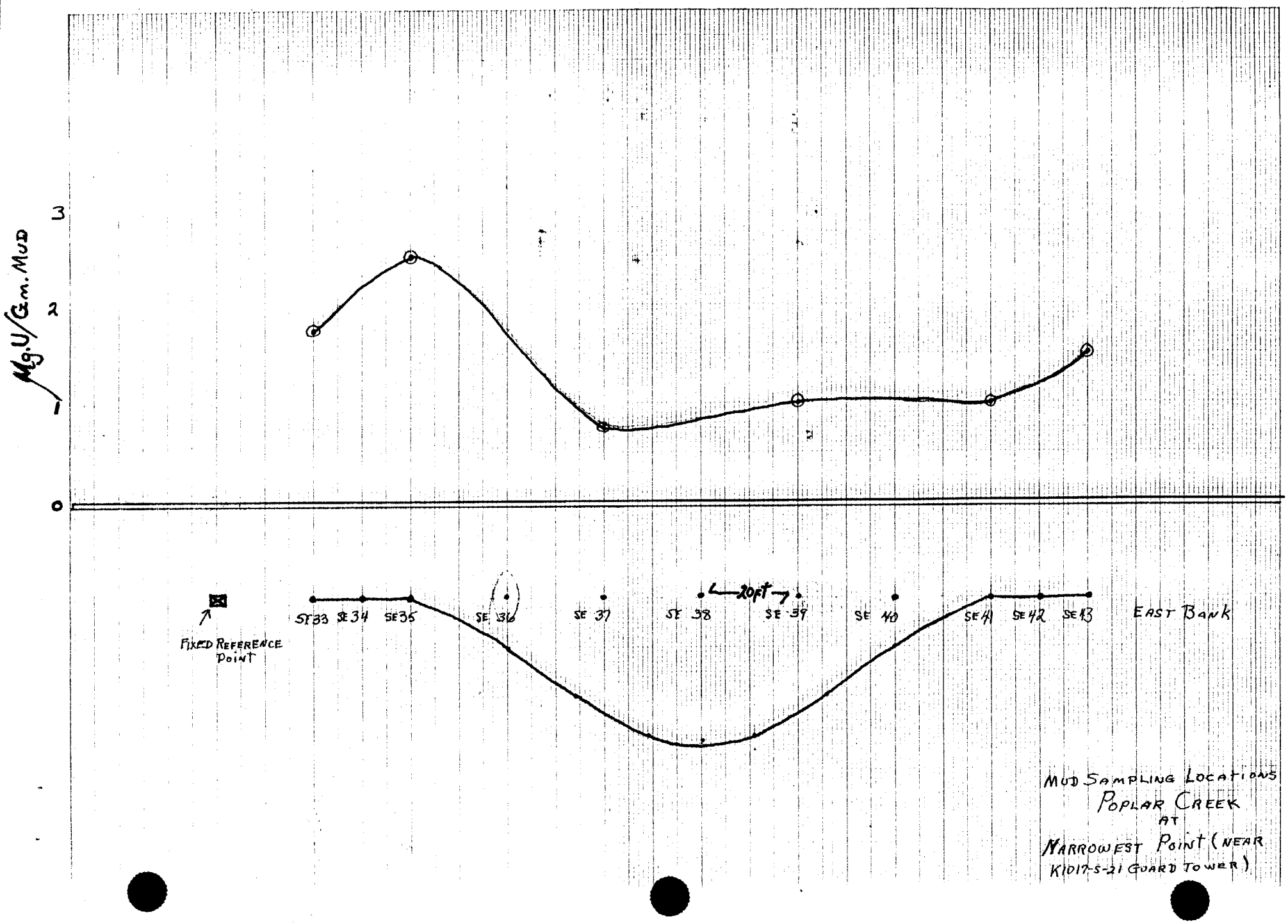
TABLE II

Sampling Point (going downstream)	MUD				WATER			
	Alpha* c/m/g		Beta** c/m/g		Alpha* c/m/l		Beta** c/m/l	
	Y-12	K-25	Y-12	K-25	Y-12	K-25	Y-12	K-25
At bridge on Bear Creek Rd.	0.17	106	120	3,038	117	37	180	490
At bridge on Gamble Valley Rd.	86.25	1.0	6,369	139,529	100	45	640	780
Near Tennis Courts in W. Vil.	4.37	422	496	66,656	83	50	100	1,260
Near West End Service Station	3.27	54	579	6,999	133	46	520	1,450
W. of Sewage Disposal Plant	0.27	171	83	29,208	100	40	520	730
At Riding Academy	No sample	174	No sample	33,509	33	24	460	910
At bridge on Turnpike	0.80	31	217	2,106	50	21	360	630
At bridge on Quarry Road	0.55	13	18	1,745	67	19	600	470
At Poplar Creek Junction	1.27	21	0.14	273	33	60	280	240
At Whitewing Intersection from Bear Creek	0.08	5.4	6.0	436	33	40	740	30

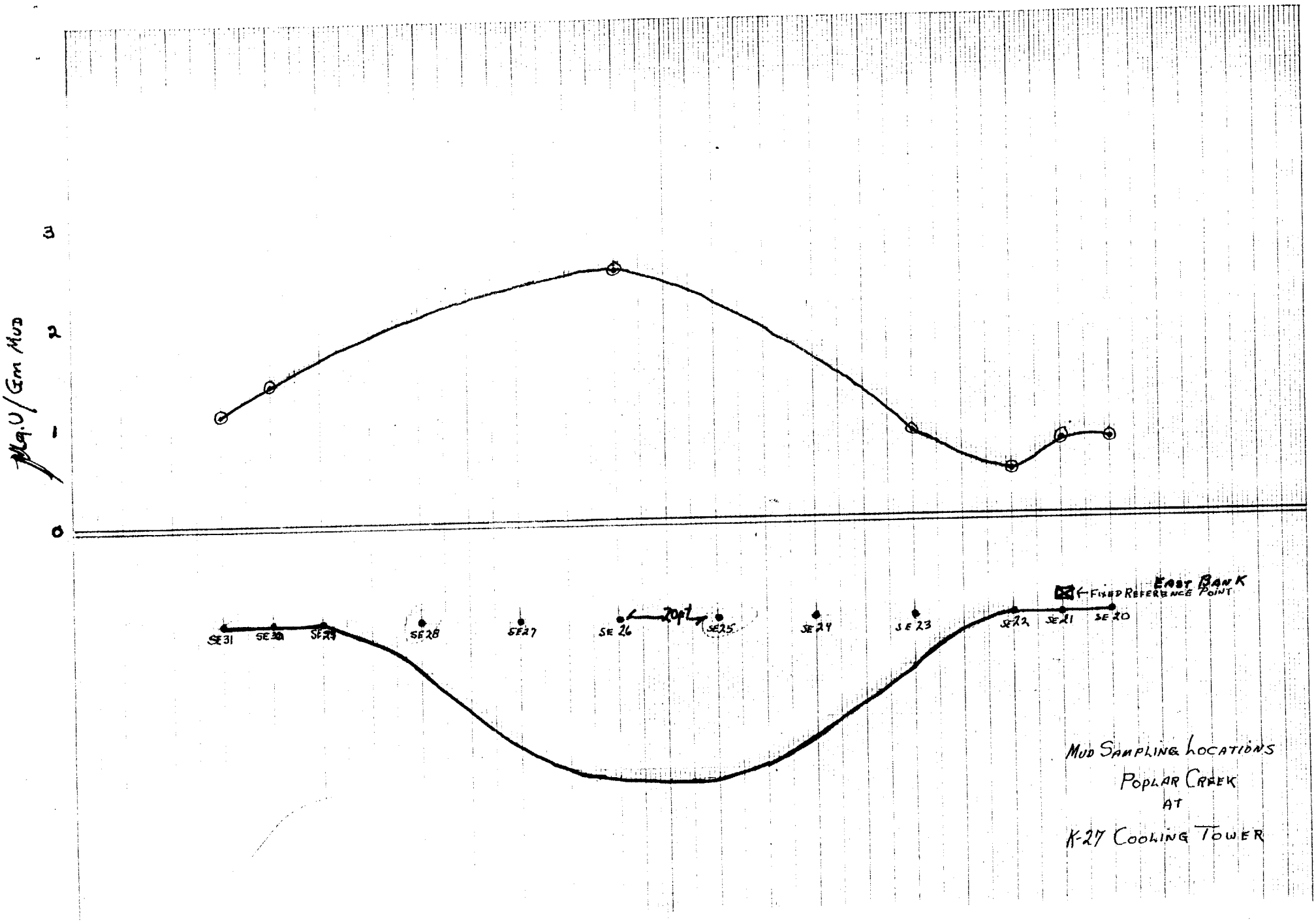
* All alpha counting at 50% geometry

** K-25 Beta counting corrected to 100% geometry - Y-12 Beta is expressed at 10% geometry.

	pH	
	10	
CJJ-1		[illegible] Mouth
2	8	Pop Co. Creek
3	8.8	[illegible]
4	8.2	Clark Run at [illegible]
5	7.7	Sanitary water
EF-1	10.4	Confluence at Zempik
2	9.5	[illegible] Rd.
3	11.2	Sulfur Run at [illegible]
4	11.0	K-12 Security Gate



MUD SAMPLING LOCATIONS
POPLAR CREEK
AT
NARROWEST POINT (NEAR
KIDIT-S-21 GUARD TOWER)


Mg. U/Gm Mud
3
2
1
0
SE31
SE30
SE29
SE28
SE27
SE 26
20ft
SE25
SE24
SE 23
SE22
SE21
SE20
FIXED REFERENCE POINT
EAST BANK
MUD SAMPLING LOCATIONS
POPLAR CREEK
AT
K-27 COOLING TOWER

MEMORANDUM

To: Mr. A. F. Becher

Subject: Cross-Stream Mud Samples - December 13, 1955

	Right Side			Center			Left Side		
	u	c	b	u	c	b	u	c	b
East Fork at Poplar	166.2	134	712	15.1	13.8	105	11.9	9.7	185
K-31 Bridge	47.7	38.0	171	65.5	56.0	412	40.7	40.0	348
Power House Effluent	15.2	13.4	230	1.6	3.8	98	5.9	5.8	175
Below Power House Effluent	2.1	3.8	251	3.4	3.9	259	14.5	14.6	283
Intersection of Poplar Creek and Clinch River	68.6	39.0	243	43.8	35.0	399	7.1	10.9	644

Average Uranium Concentration of Poplar Creek Only -

Right Side	Center	Left Side
33	29	19

Note: The cross-stream sampling indicates that there is a significant variance between the uranium concentration at the mid-stream point where samples are normally collected at the right bank of the East Fork sampling location. Also, the left bank samples show a lower concentration than at the mid-stream and the right banks at most all locations; however, this might well be expected since the main current of the stream generally flows against this bank, thus permitting greater silt movement.

It is concluded that the present procedure of collecting samples at mid-stream is adequate to show uranium concentration changes in Poplar Creek and that the average cross-stream gradient is not significantly different as to indicate any build-up of contaminated silt at locations of deposit along the stream in the K-25 drainage area.

G. S. Hill

GSH:msp

2/9/56

No K25RC

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P OAK RIDGE, TENN.

TO S. H. Smiley
LOCATION K-1401

DATE October 24, 1955

ANSWERING LETTER DATE

SUBJECT Presence of Detergents in Poplar Creek Water and Their Effect on Lime Softening

KLI-3623

ATTENTION L. L. Anthony
COPY TO J. C. Barton
A. F. Becher ✓
P. G. Dake
W. J. Holland
A. P. Huber
K. M. Jones (2)
P. R. Kuehn (3)
D. M. Lang
C. H. Mahoney
J. W. Michel
G. H. Montillon
R. C. Orrin
R. C. Rhees
J. E. Rothfleisch (35)
C. R. Schmitt
H. G. P. Snyder
M. F. Schwenn
P. R. Vanstrum
A. I. Zinck
Technical Division K-1005 File (K25RC)
Technical Division K-1401 File (K25RC)

A sample of Poplar Creek water was taken at K-891 on 10/12/55, to study the effect of lime softening on chlorination. However, attempts to lime soften produced a harder, rather than a softer, water. Tests on samples from several additional locations indicate that this surprising result is due to the presence of detergents which enter the stream in West Village sewage plant effluent. Two ppm. of commercial detergent is sufficient to nullify lime softening.

CP grade calcium oxide slacked with a small quantity of water then made to volume was used in the softening experiments. Aliquots of the samples were treated with calculated volumes of the standard lime solution and stirred for 30 minutes. The samples were allowed to set for 30 minutes and filtered. Hardness was determined by Versene titration. Dosages were calculated as CaO.

Table I shows the analysis and figure 1 shows the results of lime treatment on the sample taken at K-891 on 10/12/55. Since the data indicate the presence of 41 ppm. of noncarbonate hardness (calculated as $CaCO_3$), one would not expect efficient softening without using soda ash. However, there is nothing in the analysis to indicate that lime treatment would make the water harder. The effect is not only interesting in softening, but would make Langlier index type control very difficult or impossible.

Figures 2, 3, and 4 show the result of lime treatment on samples taken 10/18/55. from Clinch River at Gallaher Bridge, Poplar Creek 0.8 miles above the junction of East Fork, and East Fork sampled from the turnpike bridge near the Jefferson tennis courts. All show normal lime softening characteristics.

Figure 5 shows the results on a sample from East Fork taken from the bridge on the Country Club road 10/18/55. This sample has softening characteristics similar to the sample taken at K-891. It is interesting that foam was observed on aliquots from this sample while stirring in the softening experiments. The

indication is that detergents are being introduced into East Fork as throughput from the West Village sewage disposal plant. This was verified by two experiments.

"all" detergent (1) was added in varying concentrations to portions of the Clinch River sample reported in figure 2. These portions were then treated with 89 ppm. lime and the hardness determined, using the versene method. Results are shown in figure 6. With less than 1.5 ppm. of the detergent added, reasonable softening resulted. However, with 2 ppm. added, lime softening was completely nullified and the water became harder.

In the second experiment semi-quantitative methylene blue tests indicated that detergents were present in all of the samples. However, only those taken at K-891 and below the sewage disposal plant contained more than 2 ppm. visually compared to a standard solution of sodium lauryl sulfate.

From this brief survey it appears that there is enough detergent in Poplar Creek at K-891 to interfere with lime softening. Since the sewage disposal plant effluent seems to be the source of contamination, the concentration will probably fluctuate. The alkalinity data indicate that the function of the detergent is to hinder calcium carbonate floc formation. Chlorination to the breakpoint, or addition of alum, did not improve results. There are references in the literature (2, 3) that indicate that the presence of detergent can affect clarification and be a factor in corrosion.

P. R. Kuehn

P. G. Dake

A. I. Zinck
Special Analysis Department
Technical Division

/jd

(1) A product of Monsanto Chemical Co. No significance is intended in the choice of "all" for the test. It was used because it was available.

(2) Haney, P. D., et al; "Characteristics and Effects of Synthetic Detergents," Jour. AWWA, 46, 751-73 (1954).

(3) Ross, T. K., "Influence of Organic Detergents on Metal Corrosion," Metal Treatment and Drop Forging, 20, 183-7 (1953).

It will be noted that the Beta Counting at K-25 is corrected to 100% geometry whereas the Y-12 activity is expressed at approximately 10% efficiency; the alpha counts are expressed in the same geometry. There is, however, a significant difference in the total counts obtained for both alpha and beta activity with most of the readings obtained in the K-25 laboratory being considerably higher. This difference may be attributed to the time of analyses; since much of the total activity may be due to short-lived fissionable material the interval between the time of counting is probably significant. The Y-12 counting was finished several weeks after that of K-25.

It is concluded that further study is needed in order to determine the comparative efficiency in the counting operations of the two laboratories.

G. S. Hill

GSH:erc

TABLE I

ANALYSIS OF POPLAR CREEK SAMPLE
TAKEN AT K-891 10/12/55

	PPM.
Dissolved Solids	200
Suspended Solids	10
P Alkalinity as $CaCO_3$	0
M Alkalinity as $CaCO_3$	102
Calcium	43
Magnesium	7.7
Hardness as $CaCO_3$	143
PO_4 ion	3.7
Chloride ion	23
Manganese	0.26*
Mercury	0.04*
Breakpoint Chlorination	10
pH	8.1

* Analyses made by Chemical Section

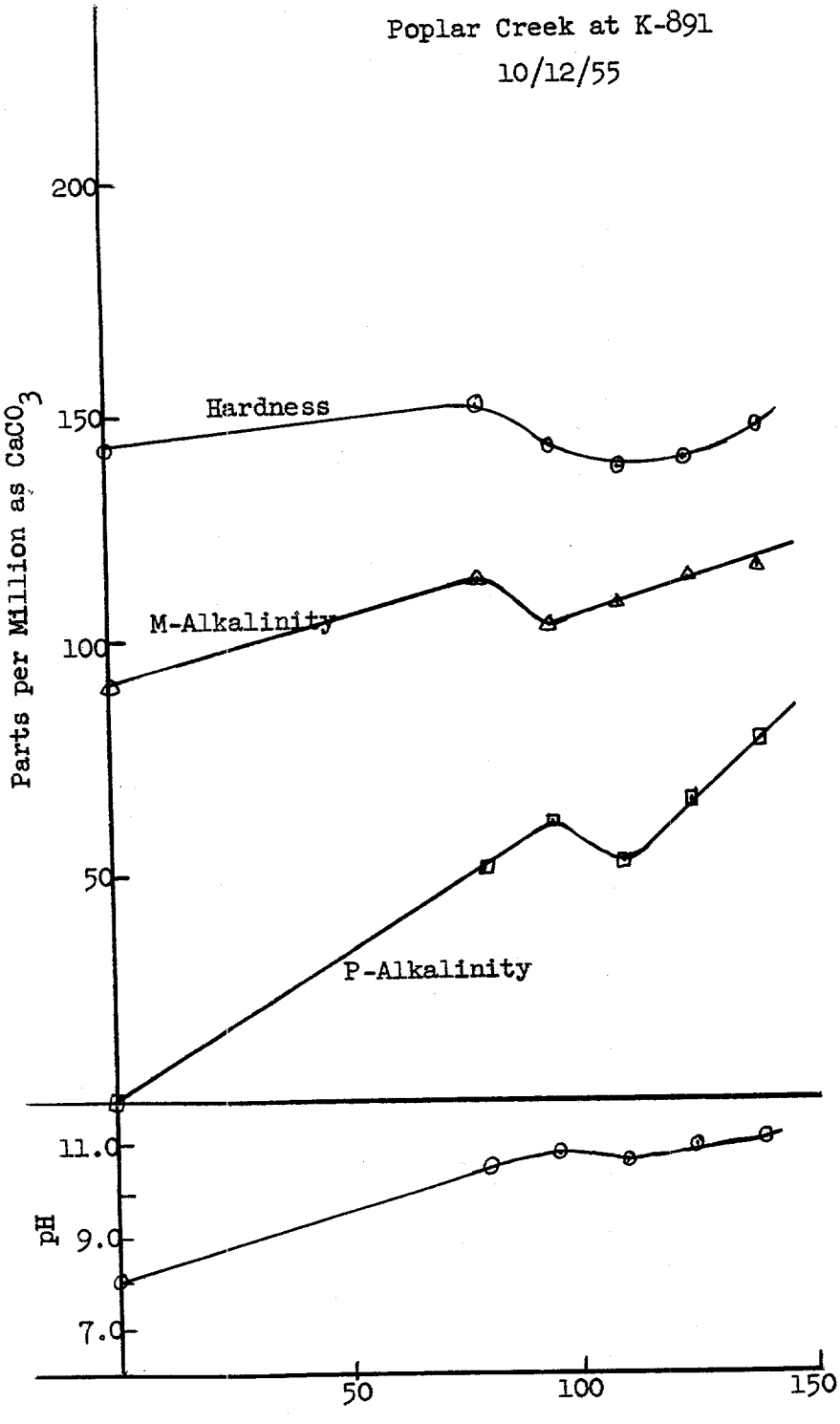

Poplar Creek at K-891
10/12/55
200
150
100
50
Parts per Million as $CaCO_3$
Hardness
M-Alkalinity
P-Alkalinity
11.0
9.0
7.0
pH
50
100
150
CaO Added, ppm.

Figure 1

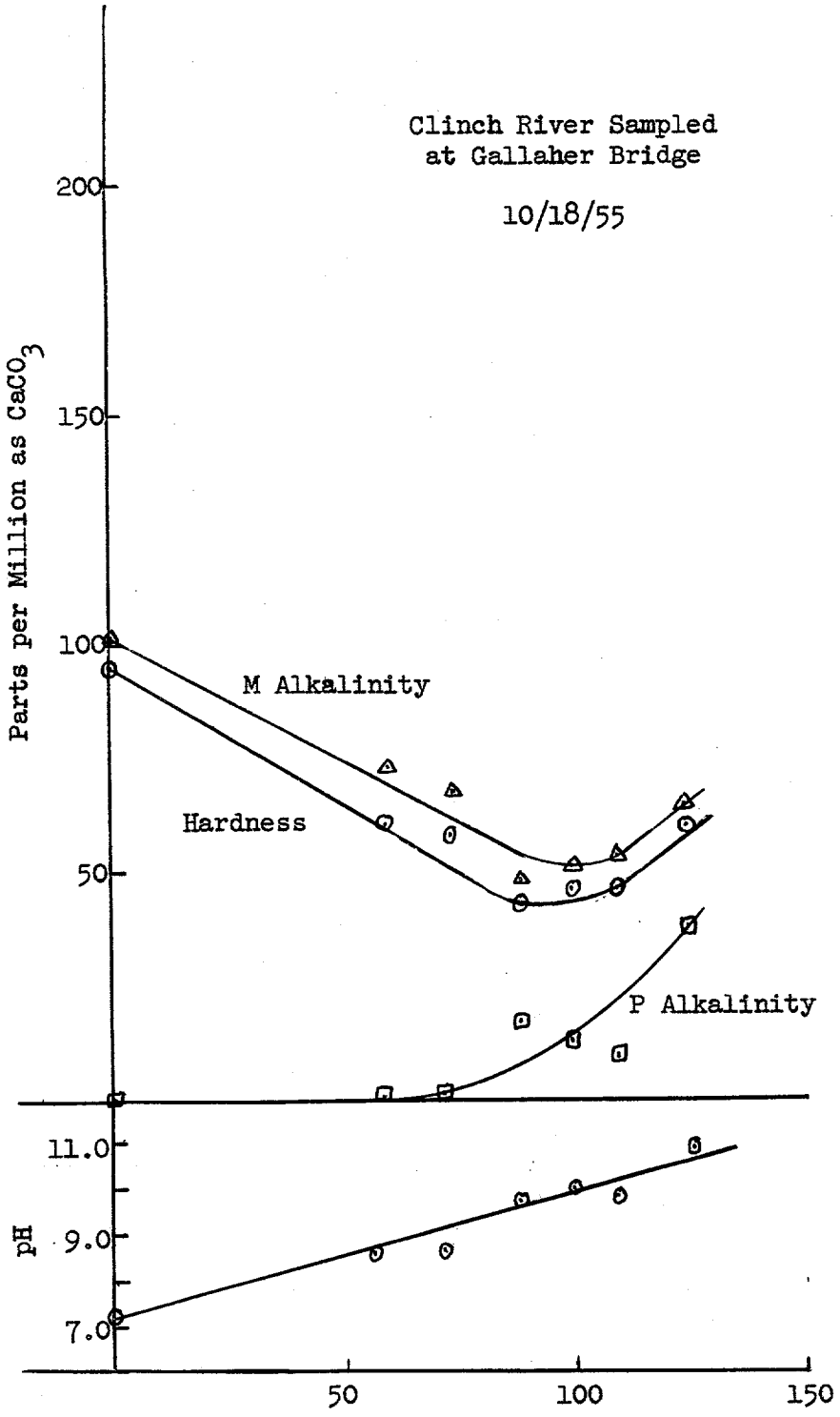

Clinch River Sampled
at Gallaher Bridge
10/18/55
Parts per Million as $CaCO_3$
200
150
100
50
M Alkalinity
Hardness
P Alkalinity
11.0
9.0
7.0
pH
50
100
150
CaO Added, ppm.

Figure 2

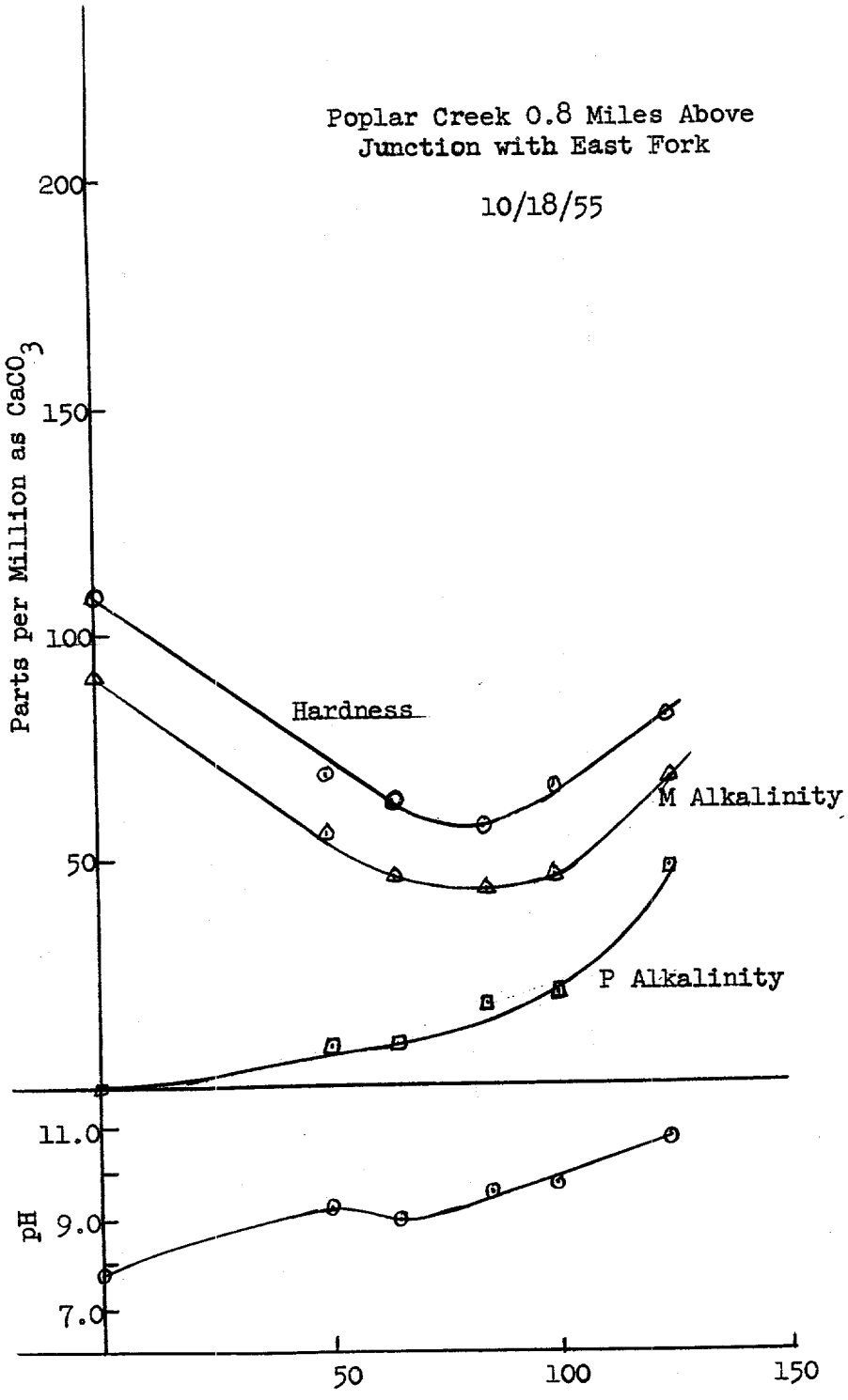

Poplar Creek 0.8 Miles Above
Junction with East Fork
10/18/55
Parts per Million as $CaCO_3$
200
150
100
50
Hardness
M Alkalinity
P Alkalinity
11.0
pH 9.0
7.0
50
100
150
CaO Added, ppm.

Figure 3

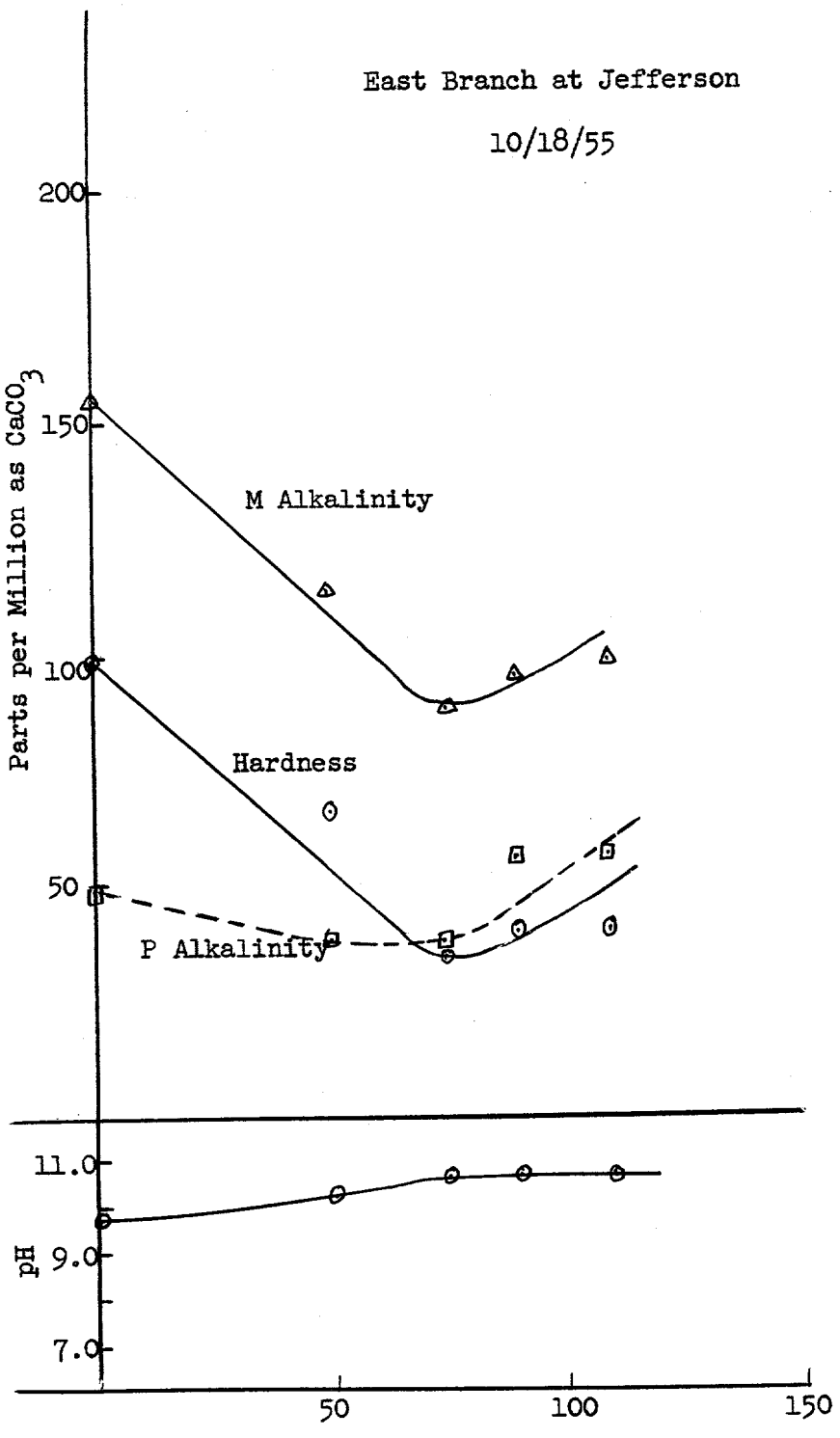

East Branch at Jefferson
10/18/55
200
150
100
50
Parts per Million as $CaCO_3$
M Alkalinity
Hardness
P Alkalinity
11.0
9.0
7.0
pH
50
100
150
CaO Added, ppm.

Figure 4

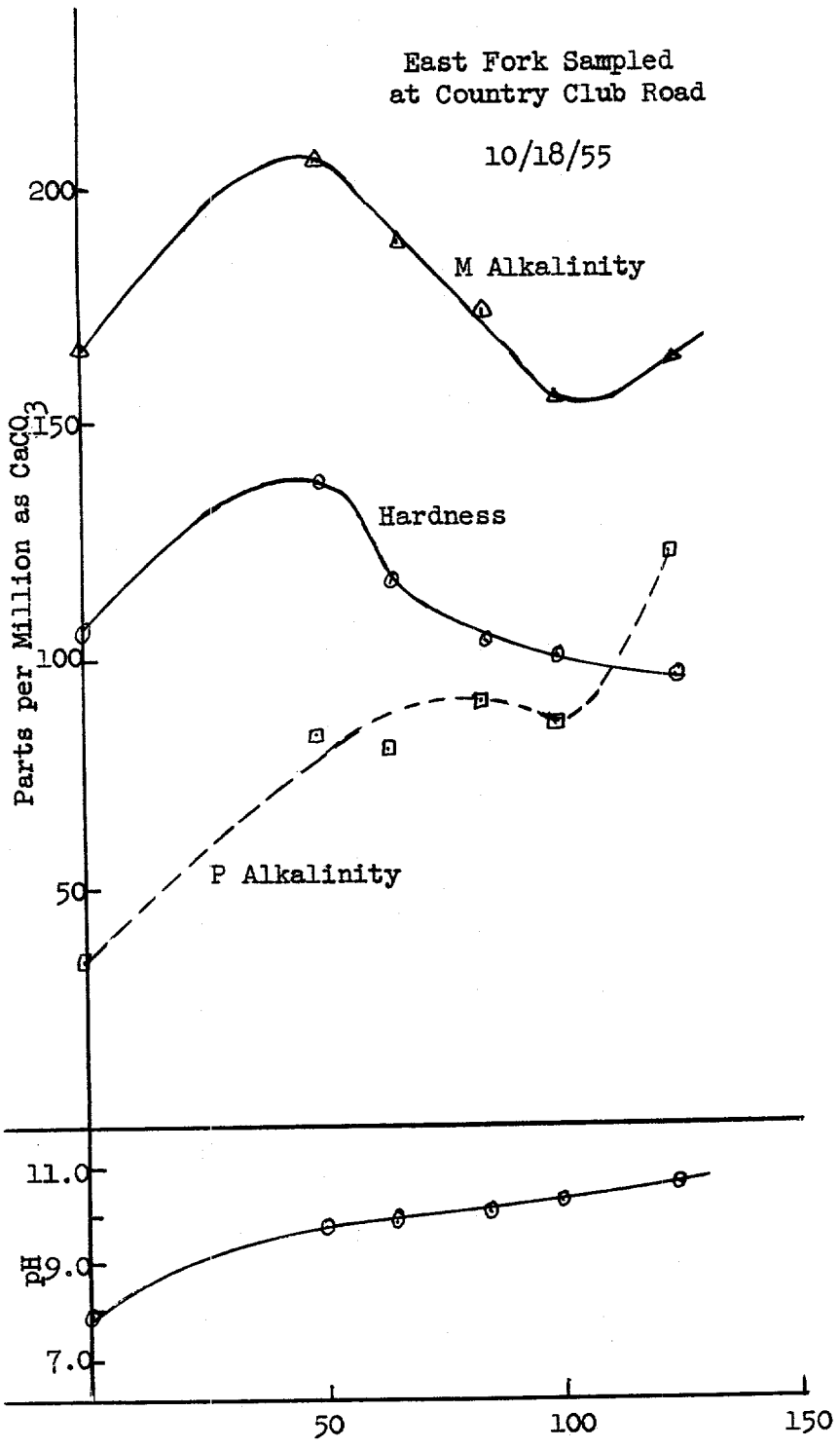

East Fork Sampled
at Country Club Road
10/18/55
M Alkalinity
Hardness
P Alkalinity
Parts per Million as $CaCO_3$
200
150
100
50
pH
11.0
9.0
7.0
50
100
150
CaO Added, ppm.

Figure 5

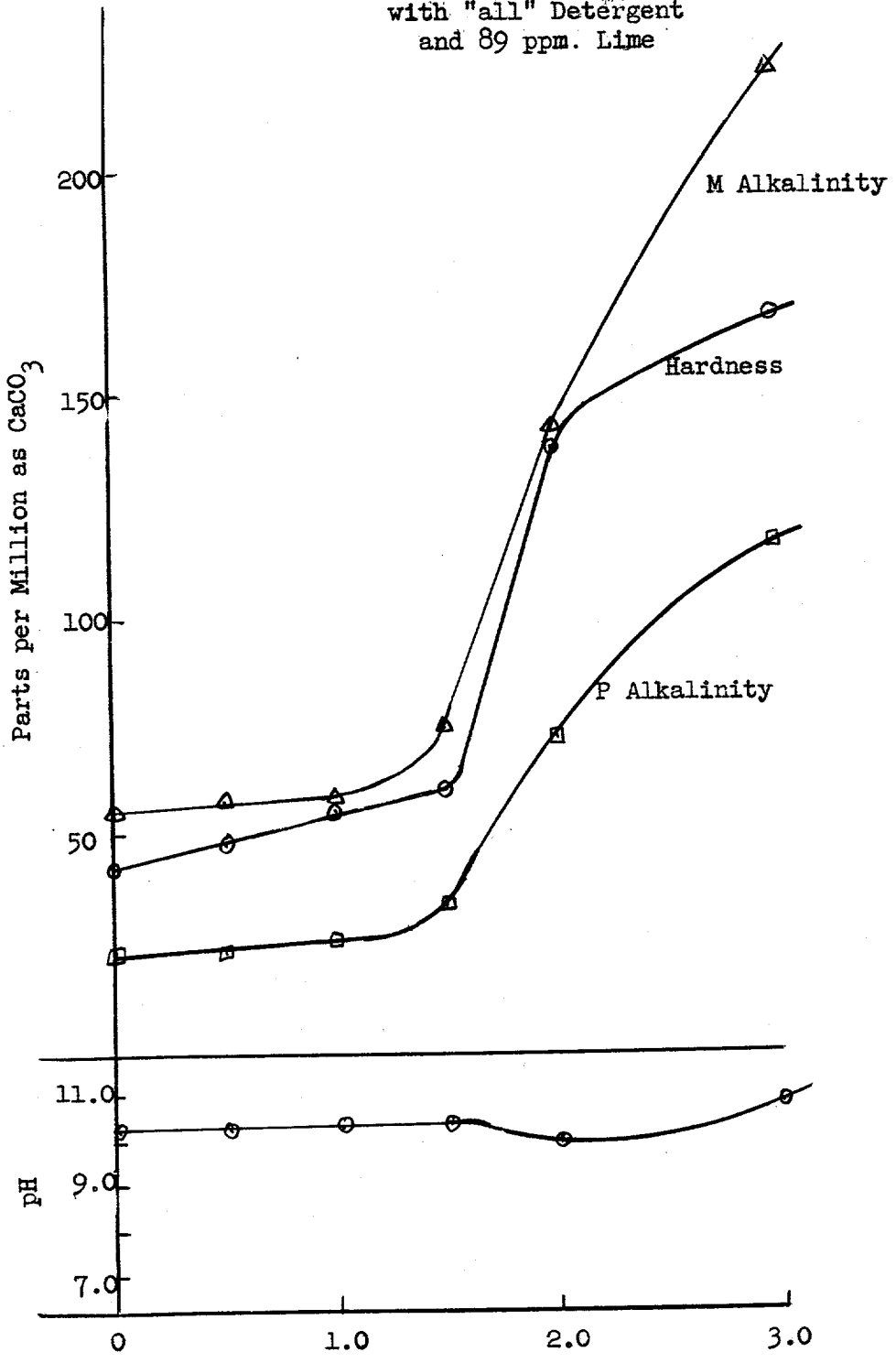

Clinch River Water with Hardness
of 95 ppm. (as $CaCO_3$) Treated
with "all" Detergent
and 89 ppm. Lime
M Alkalinity
Hardness
P Alkalinity
Parts per Million as $CaCO_3$
200
150
100
50
11.0
9.0
7.0
pH
0
1.0
2.0
3.0
"all" Detergent Added, ppm.

Figure 6

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P OAK RIDGE, TENN.

TO S. H. Smiley
LOCATION K-1401

DATE September 27, 1955

ANSWERING LETTER DATE

ATTENTION

COPY TO L. L. Anthony
J. C. Barton
A. F. Becher
P. G. Dake
W. J. Holland
K. M. Jones (2)
P. R. Kuehn (3)
D. M. Lang
C. H. Mahoney
J. W. Michel
G. H. Montillon
R. C. Orrin
R. C. Rhees
J. E. Rothfleisch
C. R. Schmitt
H. G. P. Snyder
M. F. Schwenn
P. R. Vanstrum
A. I. Zinck
Technical Division K-1005 File (K25RC)
Technical Division K-1401 File (K25RC)

SUBJECT Chlorine Demand of Poplar Creek Water

KLI-3597

A short term breakpoint chlorination study, requested by C. R. Schmitt, on Poplar Creek sampled at 891 A and "G" loop sampled from the well at the cooling towers shows these waters at present have a chlorine demand between 20 and 30 ppm. This is two to ten times higher than would be expected. To establish possible sources of contamination, several additional locations have been sampled. Clinch River and Poplar Creek above the junction of East Fork show breakpoints of less than 3 ppm. Samples from East Fork gave breakpoints below West Village sewage disposal plant of 16 and 24 ppm. East Fork above the junction with Poplar Creek gave a breakpoint of 44 ppm.

Breakpoint curves are obtained by addition of varying known amounts of chlorine to separate portions of a water sample and analyzing for the residual chlorine in each portion by one of several accepted methods. Total residual chlorine is plotted vs. chlorine added. If the sample contains organic or inorganic amines, the curve obtained passes through a minimum (the breakpoint). This results from the formation of chloramines at low chlorine concentrations contributing to the total residual chlorine result:

$$NH_3 + Cl_2 \longrightarrow NH_2Cl + HCl$$
$$NH_2Cl + Cl_2 \longrightarrow NHCl_2 + HCl$$

At higher chlorine concentrations the chloramines interact or react with chlorine to produce nitrogen and HCl:

$$NH_2Cl + NHCl_2 \longrightarrow N_2 + 3\,HCl$$
$$2\,NH_2Cl + Cl_2 \longrightarrow N_2 + 4\,HCl$$

The chlorine required for satisfactory treatment of the water can be determined from the amount which must be added to a water sample to reach the breakpoint.

Figures 1, 2, and 3 show breakpoint curves on "G" loop water, Infilco effluent and Poplar Creek at 891 A. The high breakpoints on Poplar Creek indicate the presence of amino nitrogen. At the time these samples were taken, the influent to the Infilco was being chlorinated to full existing capacity of approximately 8 ppm. with a 5 ppm. total residual appearing in the effluent. Clarification did not reduce the contamination, since the breakpoint on the effluent is shifted only 5 ppm. as expected from the total chlorine residual. This leads to the conclusion that present chlorination capacity is inadequate to deliver a good quality water to the circulating system. This is verified by the 25 ppm. breakpoint found on "G" loop water.

A survey has been initiated to establish possible sources of contamination. Figures 4 and 5 show breakpoint curves on Clinch River sampled at Gallaher Bridge and Poplar Creek 0.8 miles above the junction with East Fork. The breakpoints of less than 3 ppm. indicate that these are not the source of pollution.

Figures 6 and 7 show curves on East Fork sampled from the Turnpike bridge near the Jefferson tennis courts. The high residuals show that chlorine is being dumped upstream. In view of the high free chlorine residuals of 5 and 11 ppm. no breakpoints would be expected.

Figures 8 and 9 show curves on East Fork sampled from the bridge on the Country Club Road downstream from the West Village sewage disposal plant. The high free residuals found upstream have disappeared and combined chlorine is lower. The curves prepared using 1.5 hours contact time show a slow reaction taking place resulting in a high delayed demand.

Figure 10 shows a curve on East Fork above the junction with Poplar Creek. The ten minute contact curve shows the reaction to be faster than observed in curves 8 and 9, but considerable delayed demand remains as shown by the sharper 1.5 hour contact curve. The high breakpoint at 44 ppm. is evidently due to reactivation of discharge from the sewage disposal plant.

From this brief survey, it is evident that the chlorine demand of cooling loop water is very high. The demand will probably fluctuate widely depending on conditions upstream from the intake. East Fork is a source of high contamination, probably as the result of discharge from the West Village sewage disposal plant. The lower breakpoints observed at 891 A are the result of mixing of Poplar Creek and East Fork.

P. R. Kuehn

P. G. Dake

A. I. Zick

/jd

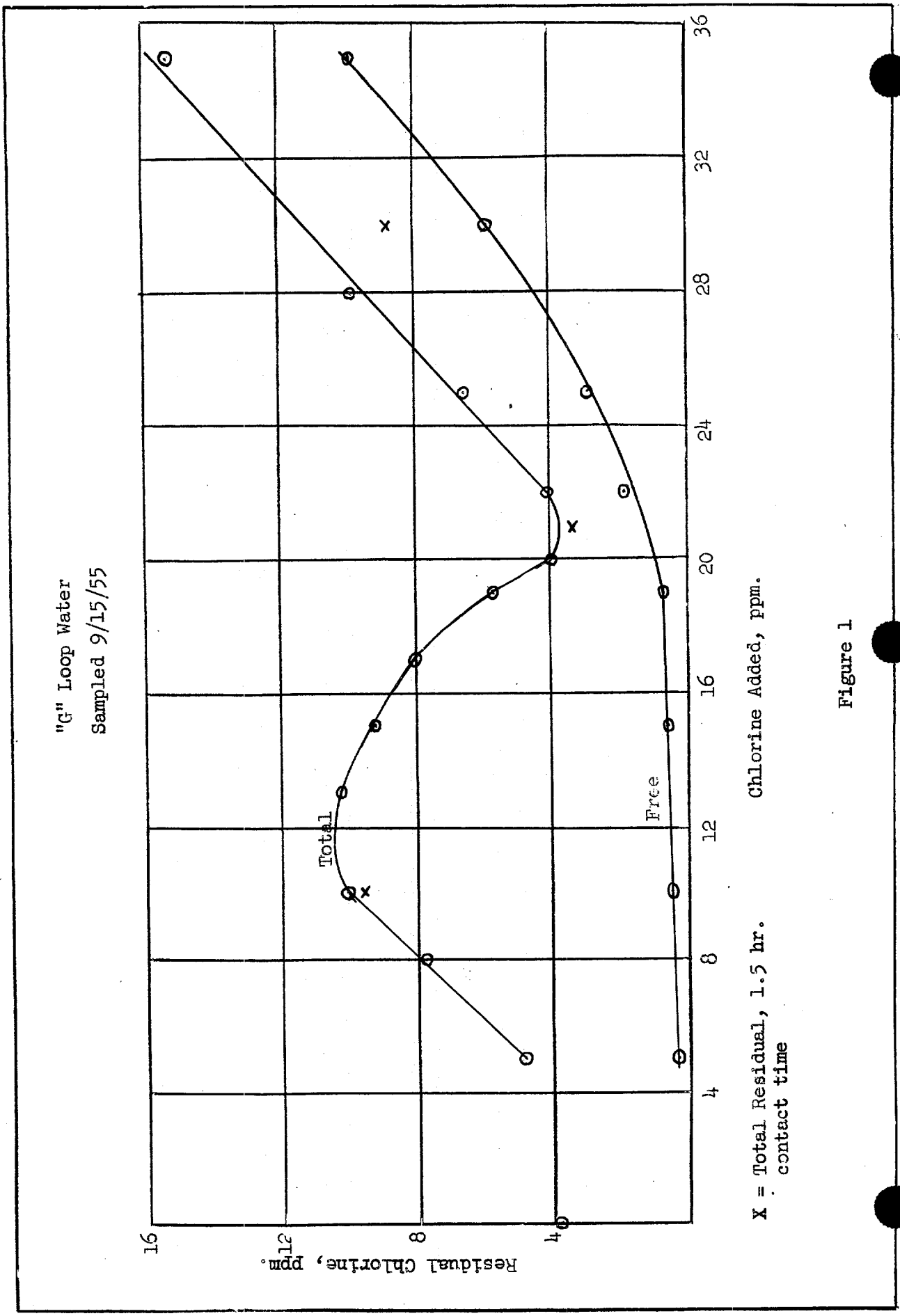

"G" Loop Water
Sampled 9/15/55
Residual Chlorine, ppm.
16
12
8
4
Total
Free
4
8
12
16
20
24
28
32
36
Chlorine Added, ppm.
X = Total Residual, 1.5 hr. contact time

Figure 1

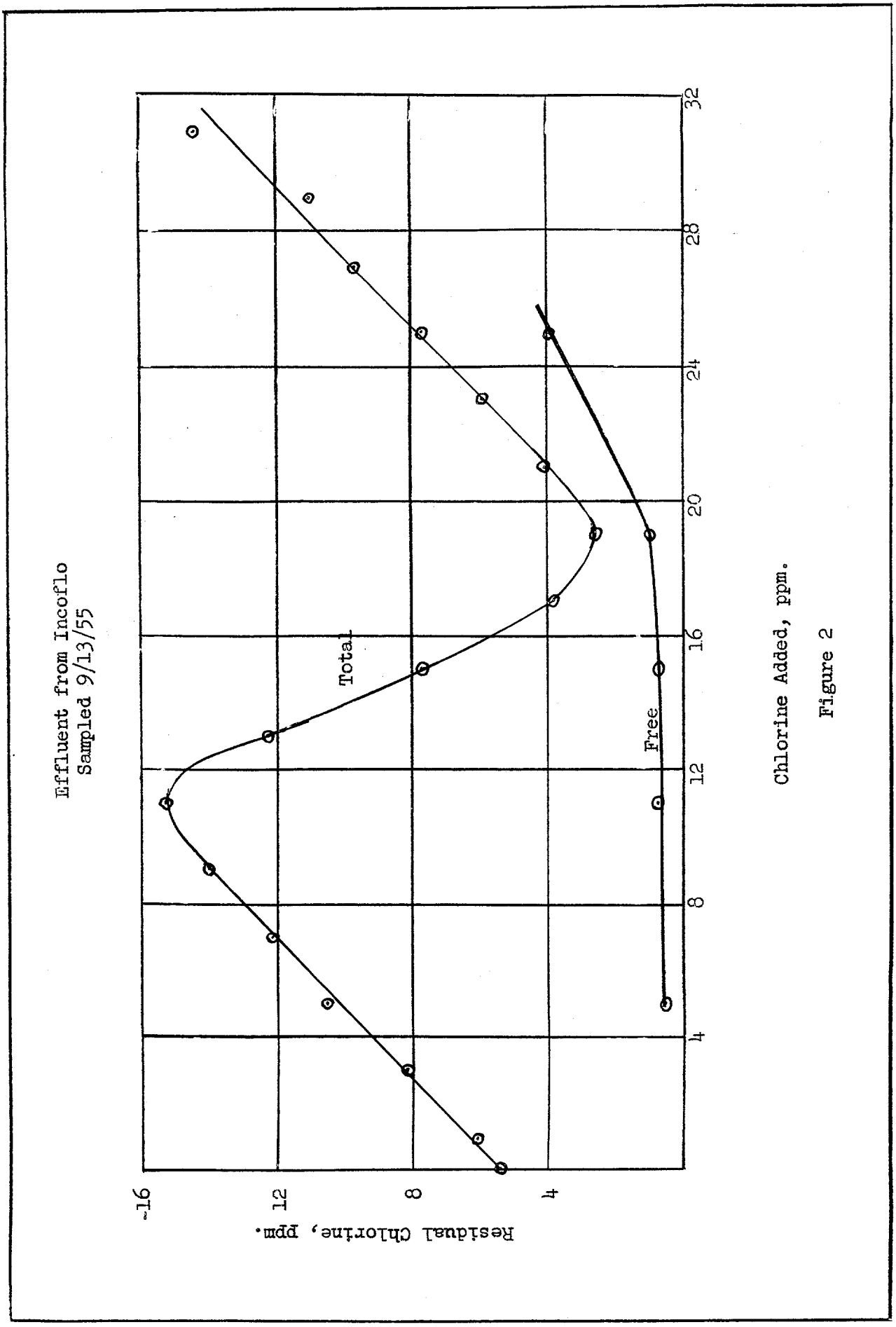

Effluent from Incoflo
Sampled 9/13/55
Residual Chlorine, ppm.
16
12
8
4
Total
Free
4
8
12
16
20
24
28
32
Chlorine Added, ppm.

Figure 2

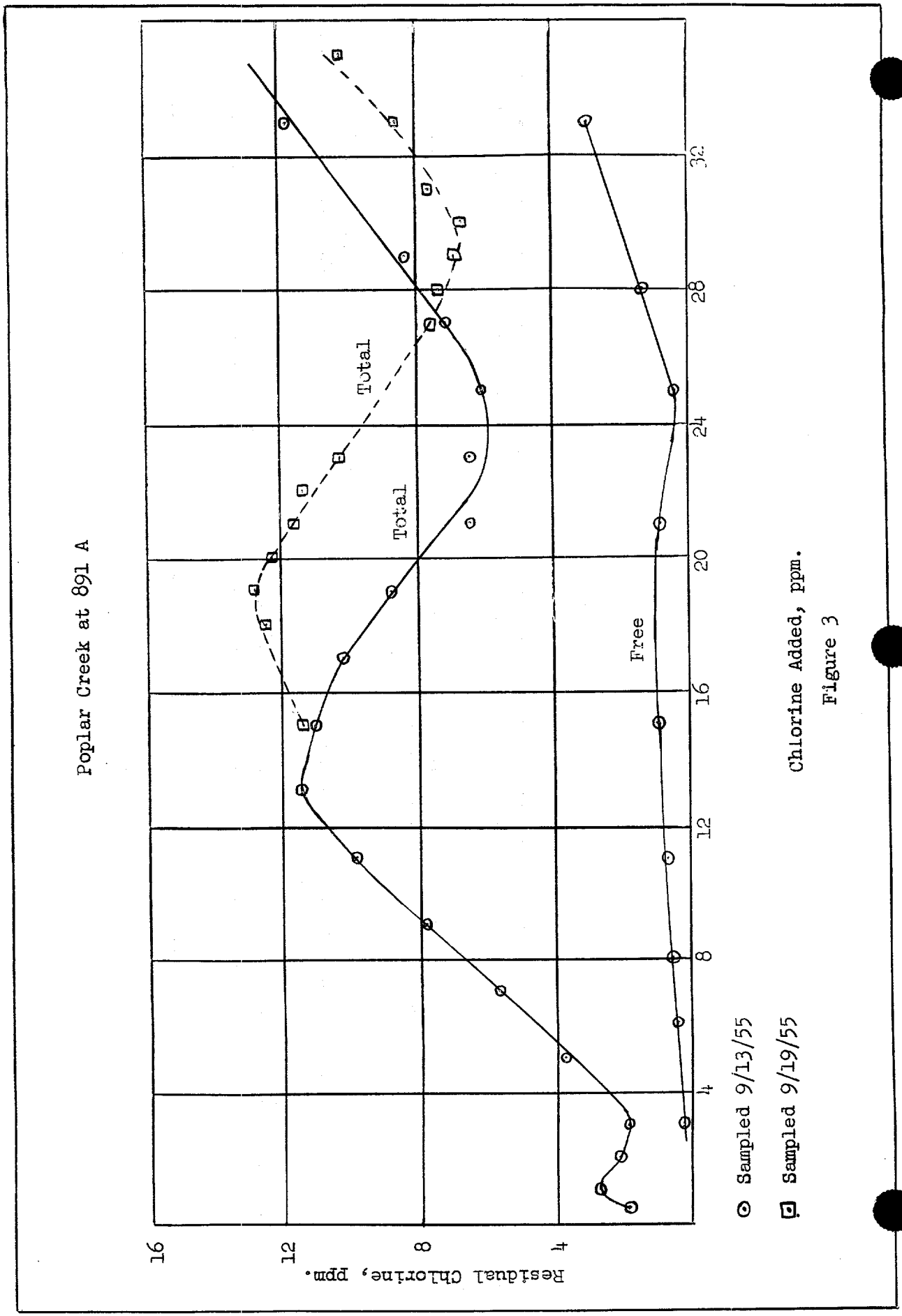

Poplar Creek at 891 A
Residual Chlorine, ppm.
16
12
8
4
4
8
12
16
20
24
28
32
Chlorine Added, ppm.
Total
Total
Free
⊙ Sampled 9/13/55
⊡ Sampled 9/19/55

Figure 3

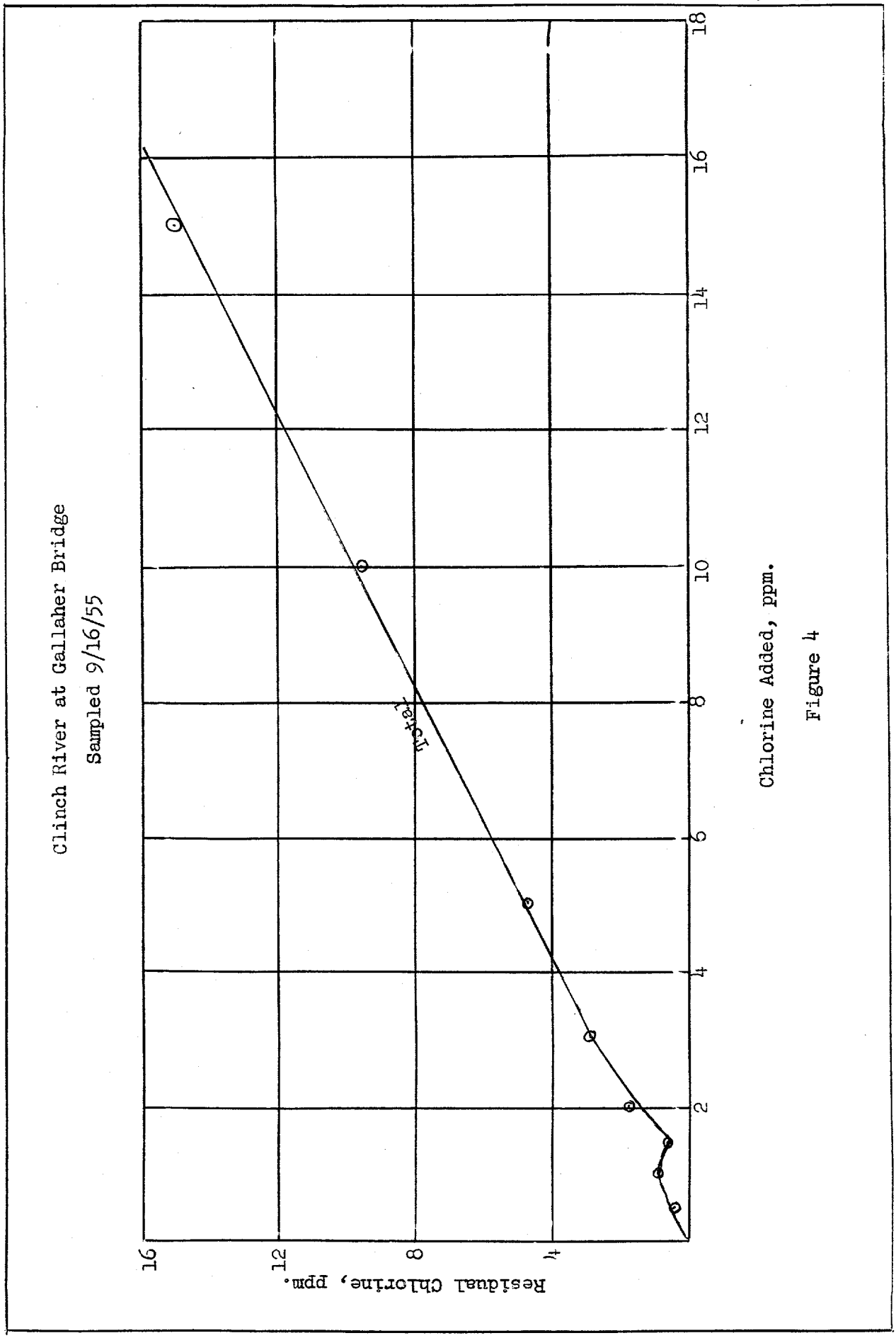

Clinch River at Gallaher Bridge
Sampled 9/16/55
Residual Chlorine, ppm.
16
12
8
4
2
4
6
8
10
12
14
16
18
Chlorine Added, ppm.

Figure 4

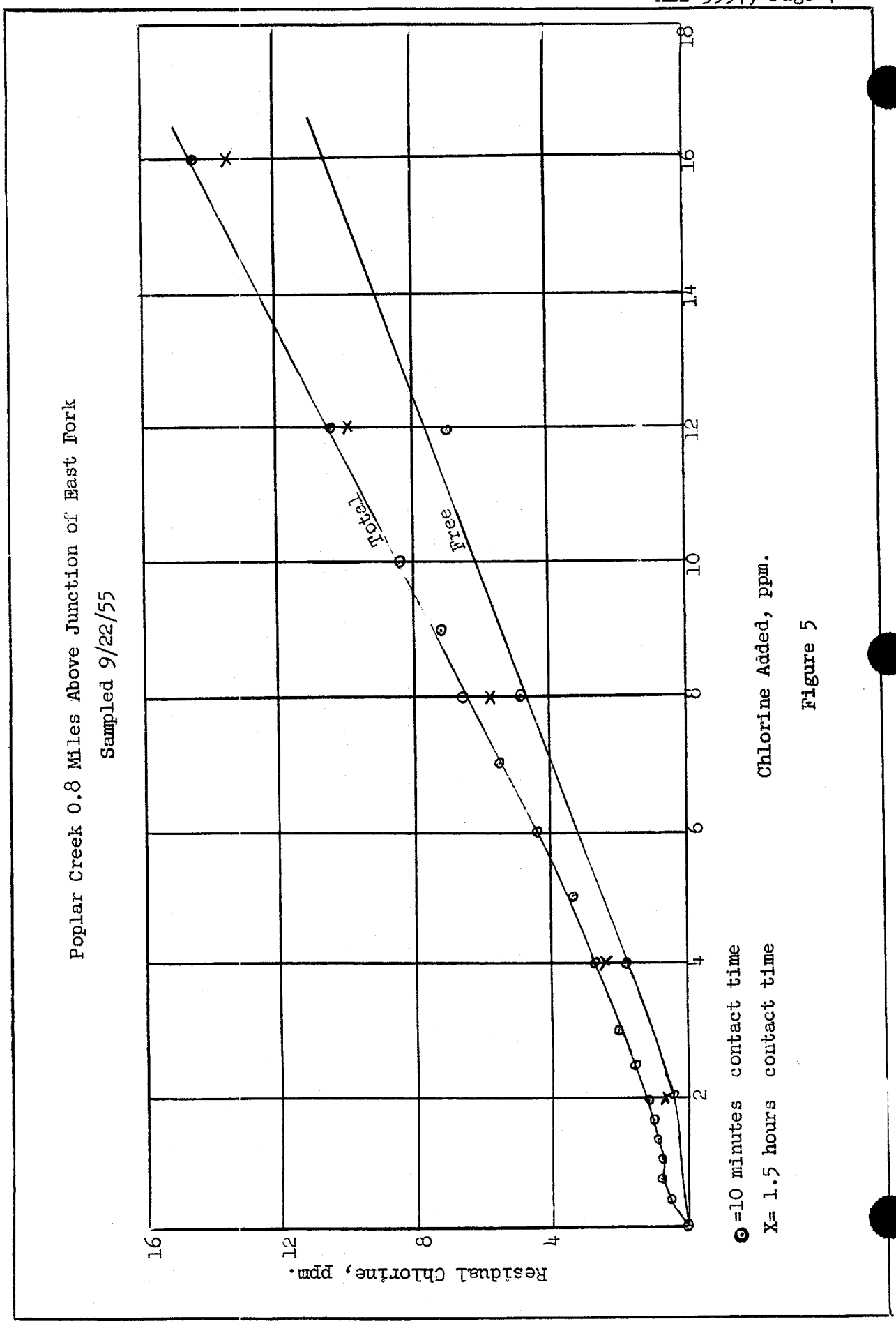

Poplar Creek 0.8 Miles Above Junction of East Fork
Sampled 9/22/55
Residual Chlorine, ppm.
16
12
8
4
2
4
6
8
10
12
14
16
18
Total
Free
⊙=10 minutes contact time
X= 1.5 hours contact time
Chlorine Added, ppm.

Figure 5

East Fork at Jefferson

Sampled 9/20/55

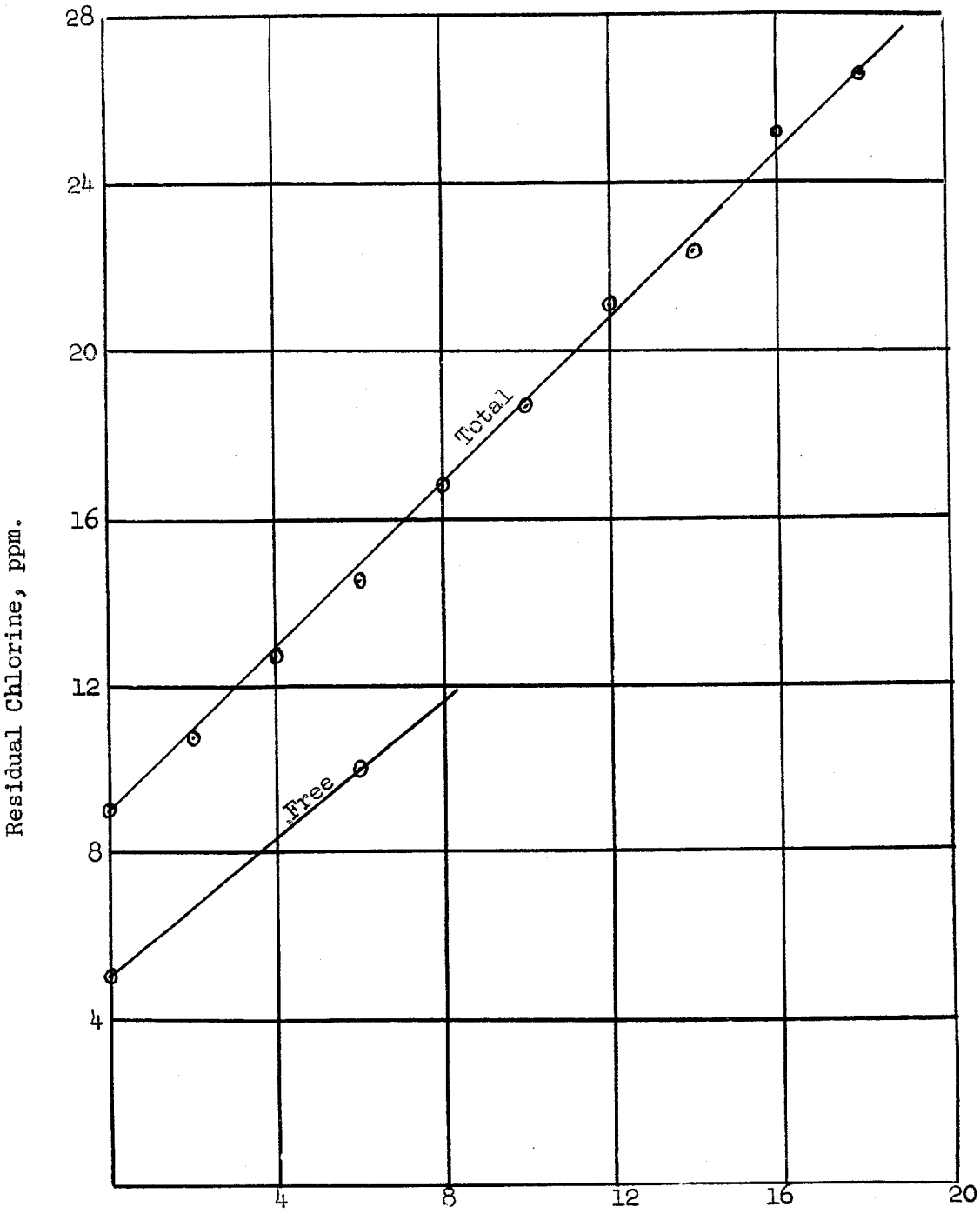
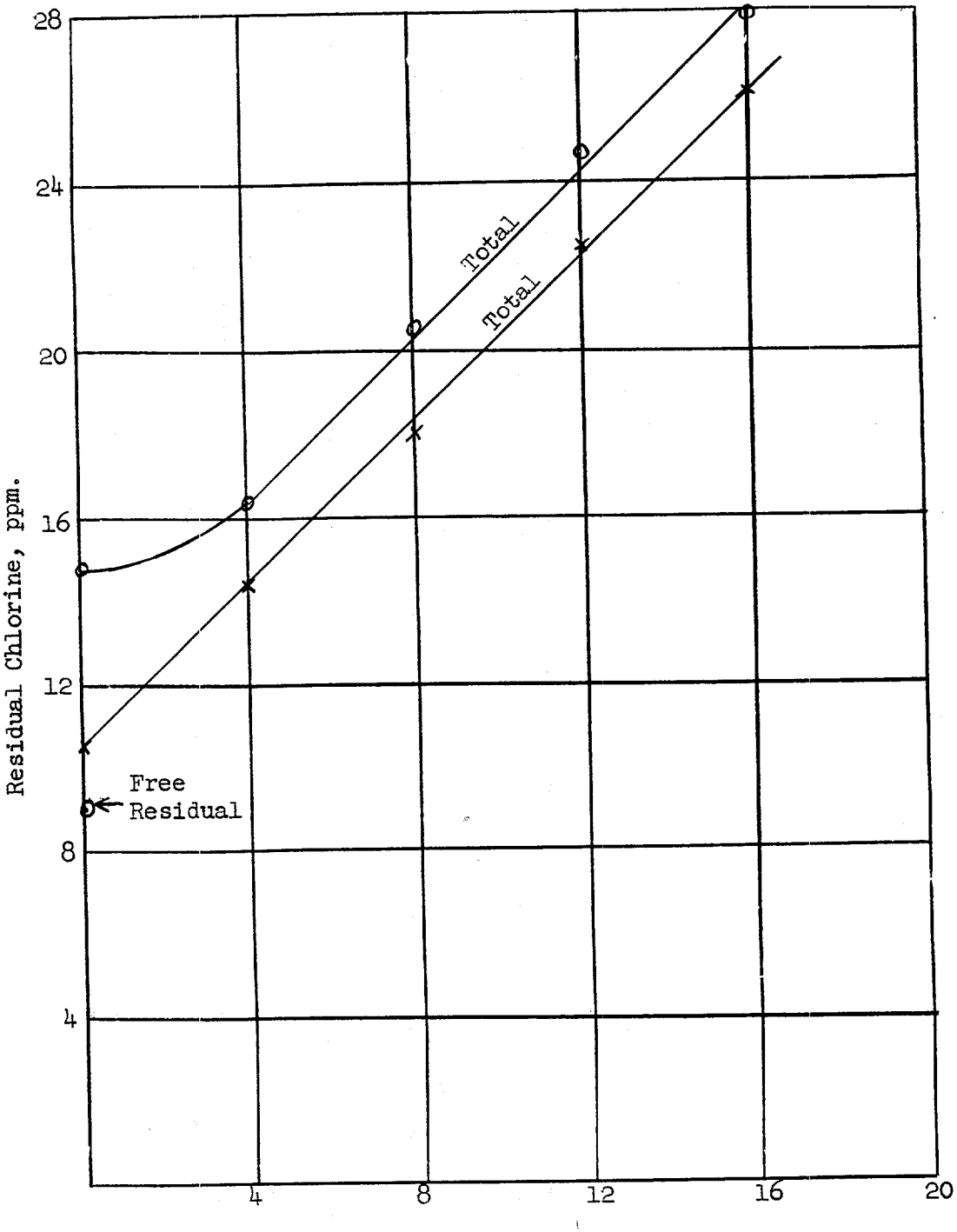


Figure 6

East Fork at Jefferson

Sampled 9/22/55



⊙ =10 minutes contact time

X = 1.5 hrs. contact time

Figure 7

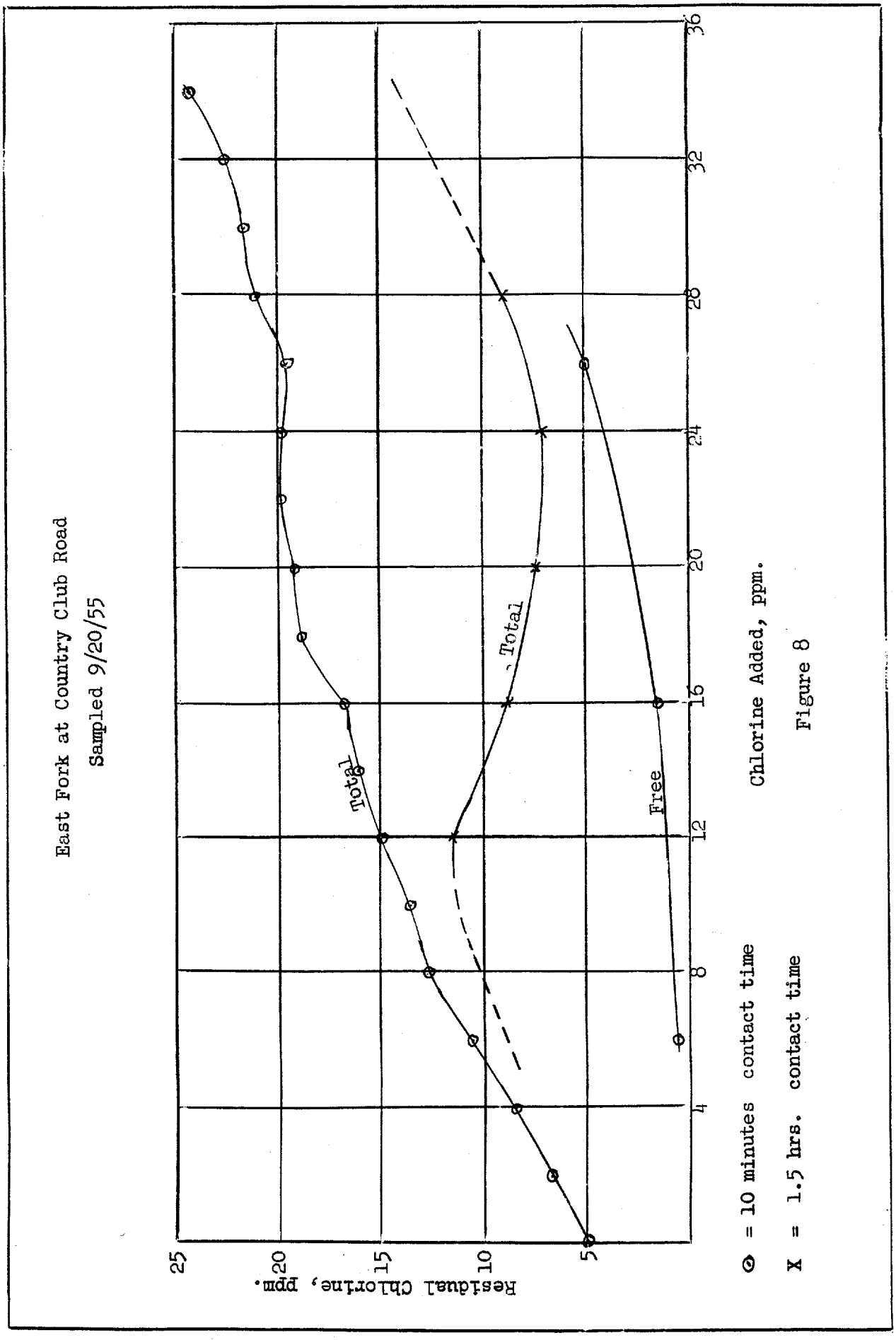

East Fork at Country Club Road
Sampled 9/20/55
Residual Chlorine, ppm.
25
20
15
10
5
4
8
12
16
20
24
28
32
36
Total
Total
Free
Chlorine Added, ppm.
⊙ = 10 minutes contact time
X = 1.5 hrs. contact time

Figure 8

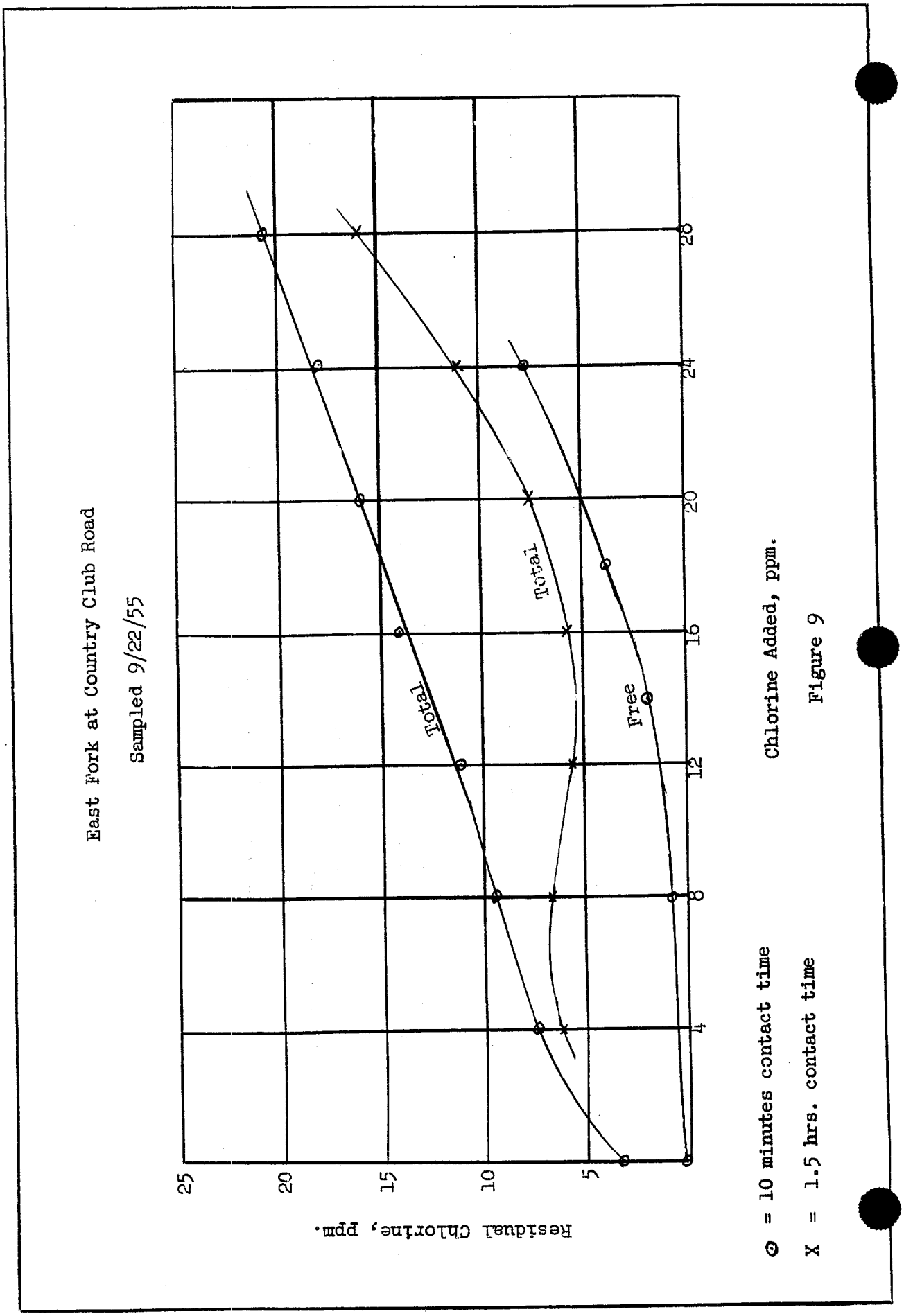
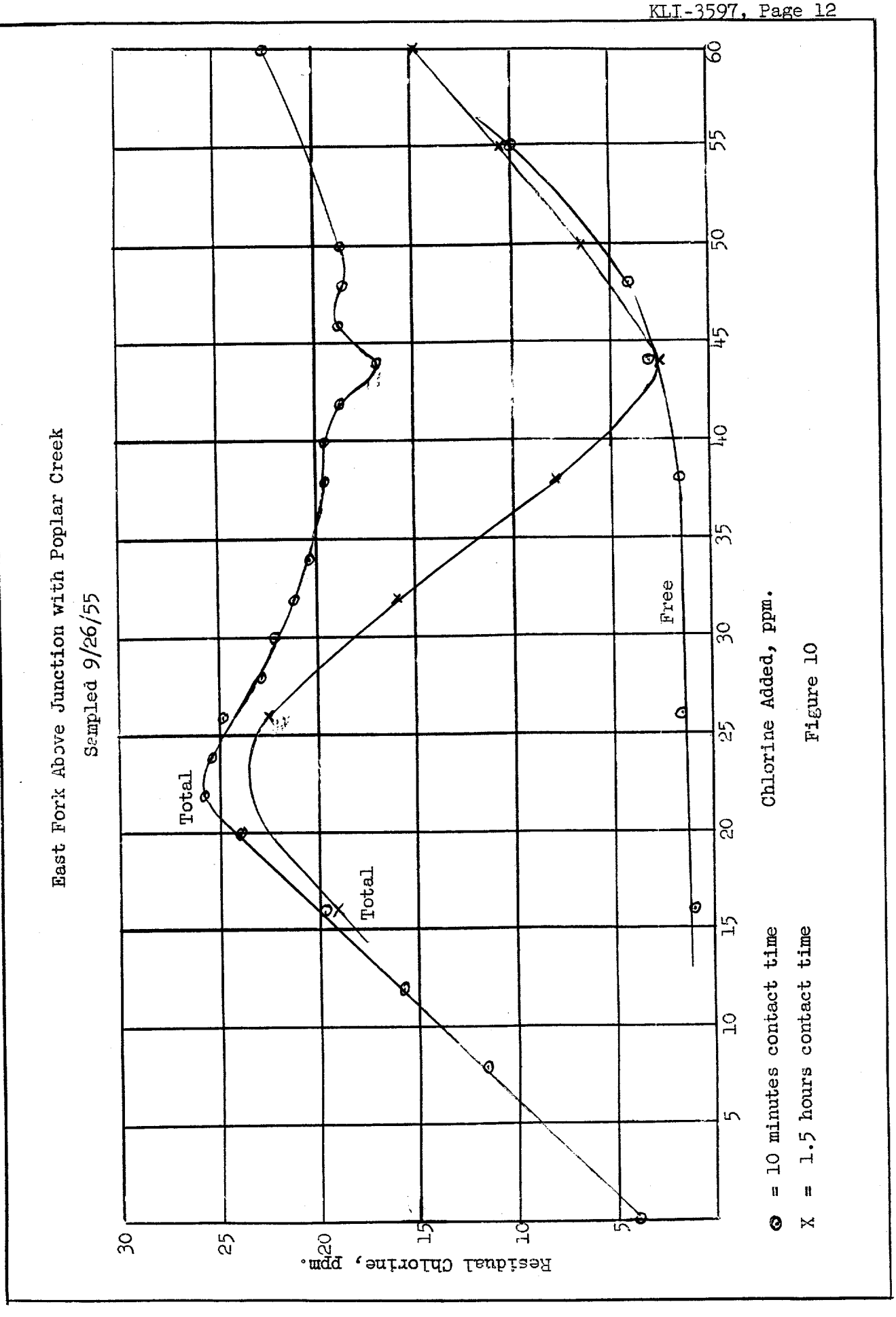

East Fork at Country Club Road
Sampled 9/22/55
Residual Chlorine, ppm.
25
20
15
10
5
4
8
12
16
20
24
28
Total
Total
Free
Chlorine Added, ppm.
⊙ = 10 minutes contact time
X = 1.5 hrs. contact time

Figure 9



● = 10 minutes contact time

X = 1.5 hours contact time

Figure 10

MEMO AVOID ORAL INSTRUCTIONS Date 4/5 19

To Dr H J Henry

Attached are results of investigation by Lab to determine source of bacteria believed to be a factor in plugging coolant systems at K25 - According to Kuehn they have pretty well established the O.C. disposal plant (west end) as the source - effluent samples indicated a break point of 40 ppm - only interest we have is that this could also be a factor in producing dead fish from time to time

Thanks

Signed [illegible]

WCX-48 (7-50)

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P OAK RIDGE, TENN.

TO S. H. Smiley
LOCATION K-1401

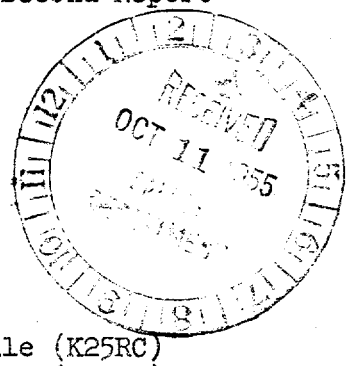
DATE October 6, 1955

ANSWERING LETTER DATE

ATTENTION
COPY TO L. L. Anthony
J. C. Barton
A. F. Becher ✓
P. G. Dake
W. J. Holland
K. M. Jones (2)
V. G. Katzel
P. R. Kuehn (3)
D. M. Lang
C. H. Mahoney
J. W. Michel
G. H. Montillon
R. C. Orrin
R. C. Rhees
J. E. Rothfleisch (36)
C. R. Schmitt
H. G. P. Snyder
M. F. Schwenn
A. I. Zinck
Technical Division K-1005 File (K25RC)
Technical Division K-1401 File (K25RC)

SUBJECT Chlorine Demand of Poplar Creek Water - Second Report

KLI-3603



From the brief breakpoint chlorination survey presented in KLI-3597, it was evident that the chlorine demand of Poplar Creek water at the Oak Ridge Gaseous Diffusion Plant was very high. East Fork was indicated as the source of pollution. This report presents curves on six additional samples. A breakpoint of 6 ppm. was found for Clinch River below the junction of Poplar Creek. Effluent from the West Village sewage disposal plant gave a breakpoint of 94 ppm.

Figures 1 and 2 show curves on three day composites taken at the intake pumps at 891. The composites were completed September 23 and 30 and were supplied by K. M. Jones. They show breakpoints of 20 and 28 ppm., respectively, which is in the same range previously found for this sampling point.

Figure 3 shows a curve on a sample submitted by C. C. Fowlkes, taken at the intake to 891 on September 28. The stream is ten feet deep at this point and the sample was taken at a depth of seven feet. The purpose was to see if chlorine demand varied with stream depth. The breakpoint of 26 ppm. indicates that there is no great difference between surface and bottom samples.

Figure 4 shows a curve on Clinch River sampled approximately three-fourths of a mile below the junction of Poplar Creek. The sample was supplied by K. M. Jones. The breakpoint of 6 ppm. shows the expected dilution with Clinch River.

Figure 5 shows a curve on West Village sewage plant effluent taken at the outlet of the final chlorination tank. This sample was obtained on a visit to the plant October 3 by R. C. Rhees, P. R. Kuehn, and A. I. Zinck. M. F. Grant and E. B. Monroe of Management Services conducted the tour.

The installation is a primary treatment plant designed to remove 40 to 60% of the input solids with a maximum capacity of 7×10^6 gpd. The modal load is 3×10^6 gpd., but in rainy periods it is sometimes necessary to by-pass the plant entirely. In these cases, input is chlorinated as well as possible from a diffuser in the main and diverted directly to East Fork. The plant has three 200 pound chlorinators and for modal operations uses 225 to 250 pounds of chlorine per day. Operating procedure calls for a free chlorine residual of 1 ppm. as determined by OTA test on the effluent from the final chlorination tank. It was estimated that at best operation, 1000 to 1100 pounds of solids were being dumped in East Fork daily. The breakpoint found on the effluent sample was 94 ppm.

Figure 6 shows a curve on K-31 loop water supplied by K. M. Jones on October 3. Heavy chlorination had been started on this loop in preparation for using Coraid. The data indicate that chlorine demand of the water had been satisfied. A resample taken October 4 gave a free residual of 5 ppm. and no curve was prepared.

The six curves in this report with the eleven reported in KLI-3597 define the situation as regards present chlorine demand of area waters. No inference is intended as to the role of high chlorine demand in corrosion. It is generally felt that complete chlorination of loop cooling waters would be desirable. However, further work is needed to study the effect of heavy chlorination on other water treatment processes and corrosion.

P. G. Dake

A. I. Zinck

P. R. Kuehn
Special Analysis Department
Technical Division

/jd

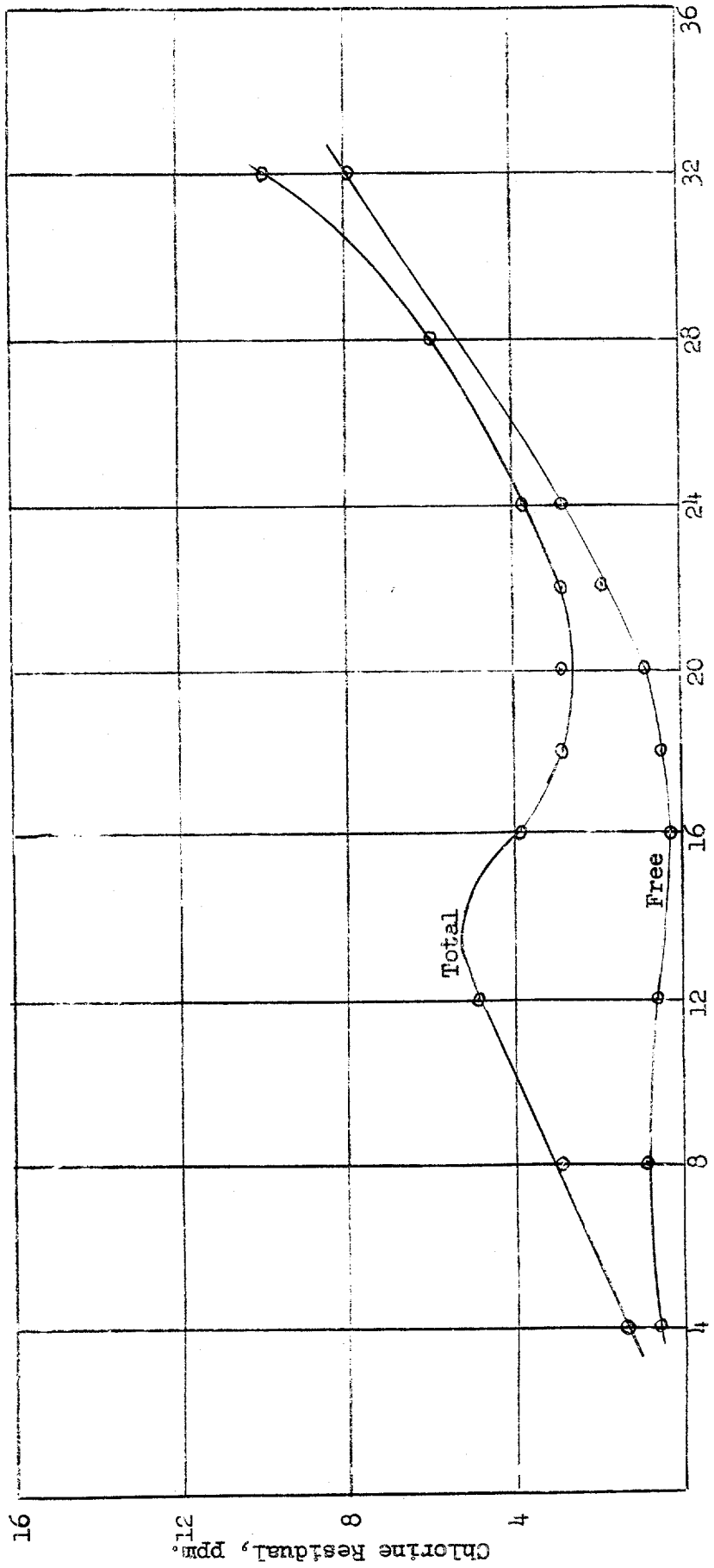

Poplar Creek at 891
Three Day Composite Completed 9/23/55
Chlorine Residual, ppm.
16
12
8
4
Total
Free
4
8
12
16
20
24
28
32
36
Chlorine Added, ppm.

Figure 1

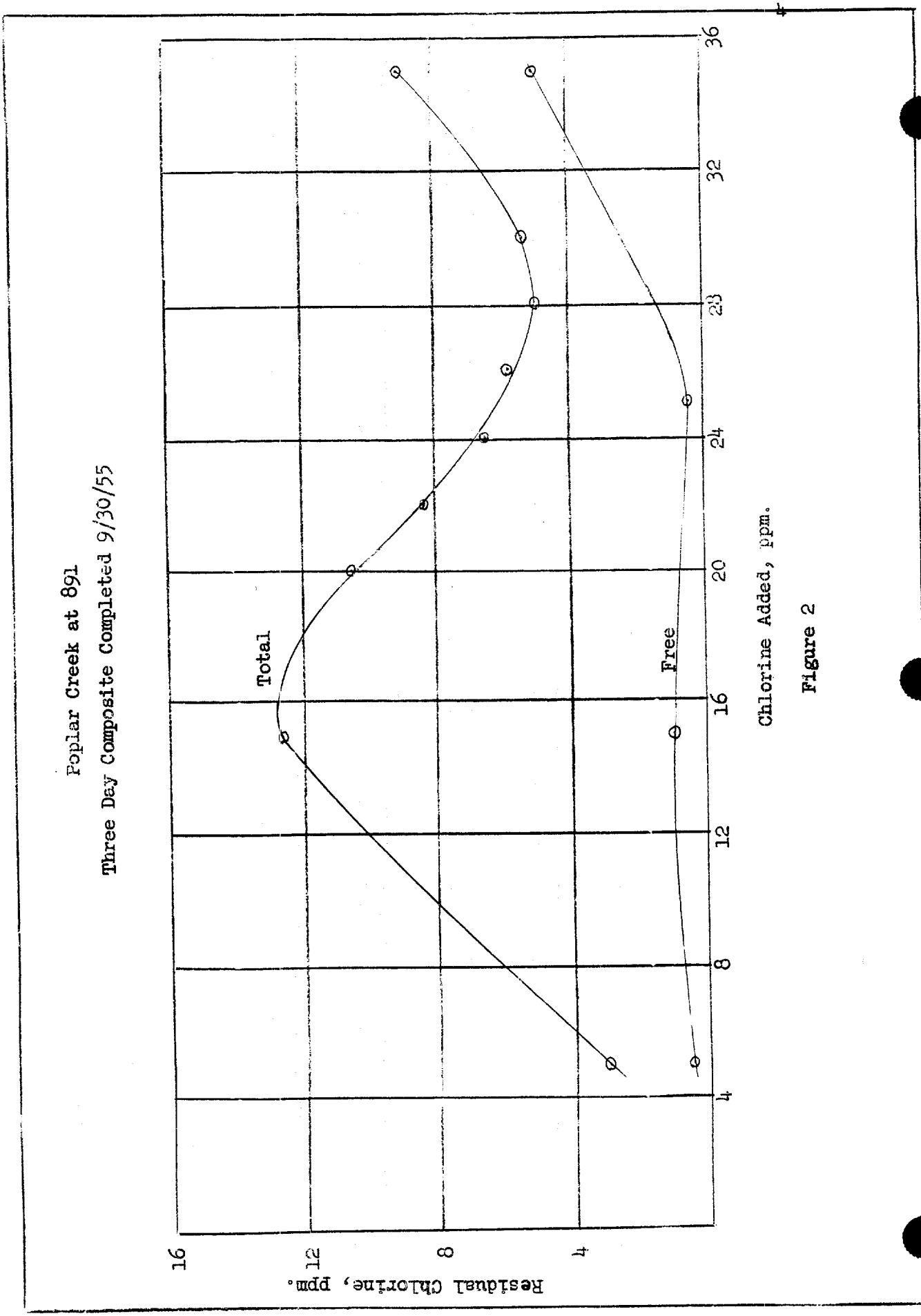

Poplar Creek at 891
Three Day Composite Completed 9/30/55
Residual Chlorine, ppm.
16
12
8
4
Total
Free
4
8
12
16
20
24
28
32
36
Chlorine Added, ppm.

Figure 2

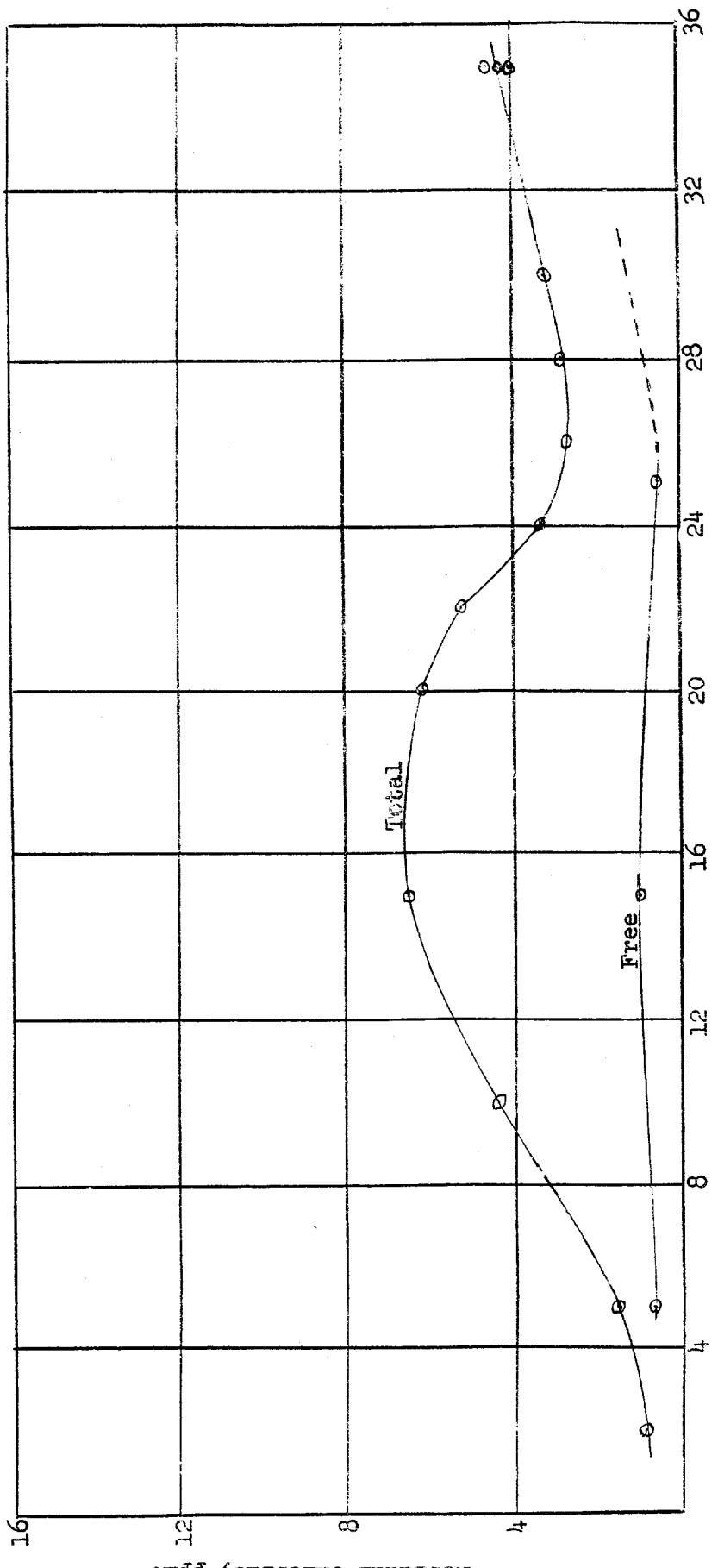

Poplar Creek at 891
Sample Taken 9/28/55, Three Feet from Bottom
Residual Chlorine, ppm.
16
12
8
4
Total
Free
4
8
12
16
20
24
28
32
36
Chlorine Added, ppm.

Figure 3

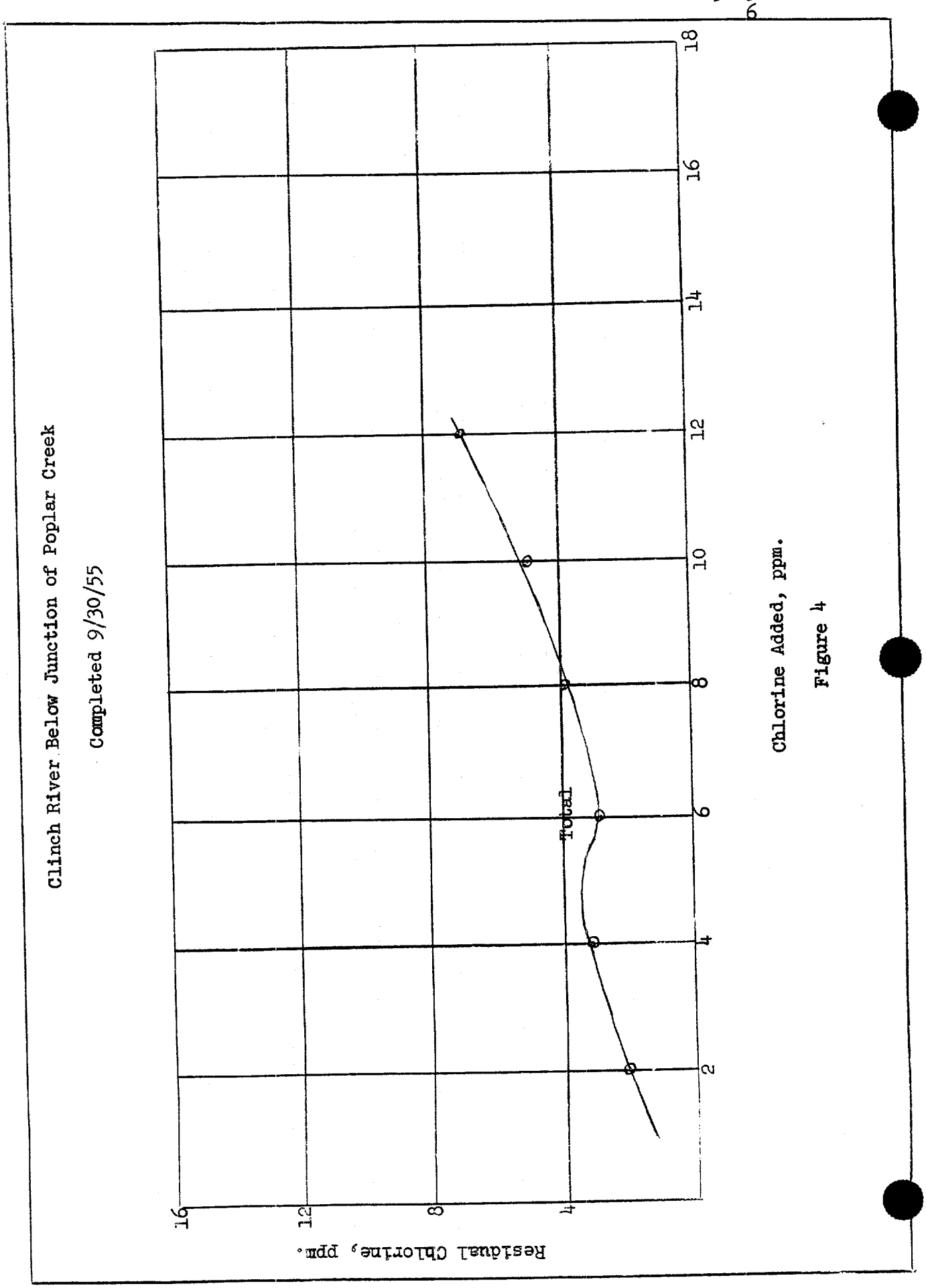

Clinch River Below Junction of Poplar Creek
Completed 9/30/55
Residual Chlorine, ppm.
16
12
8
4
Total
2
4
6
8
10
12
14
16
18
Chlorine Added, ppm.

Figure 4

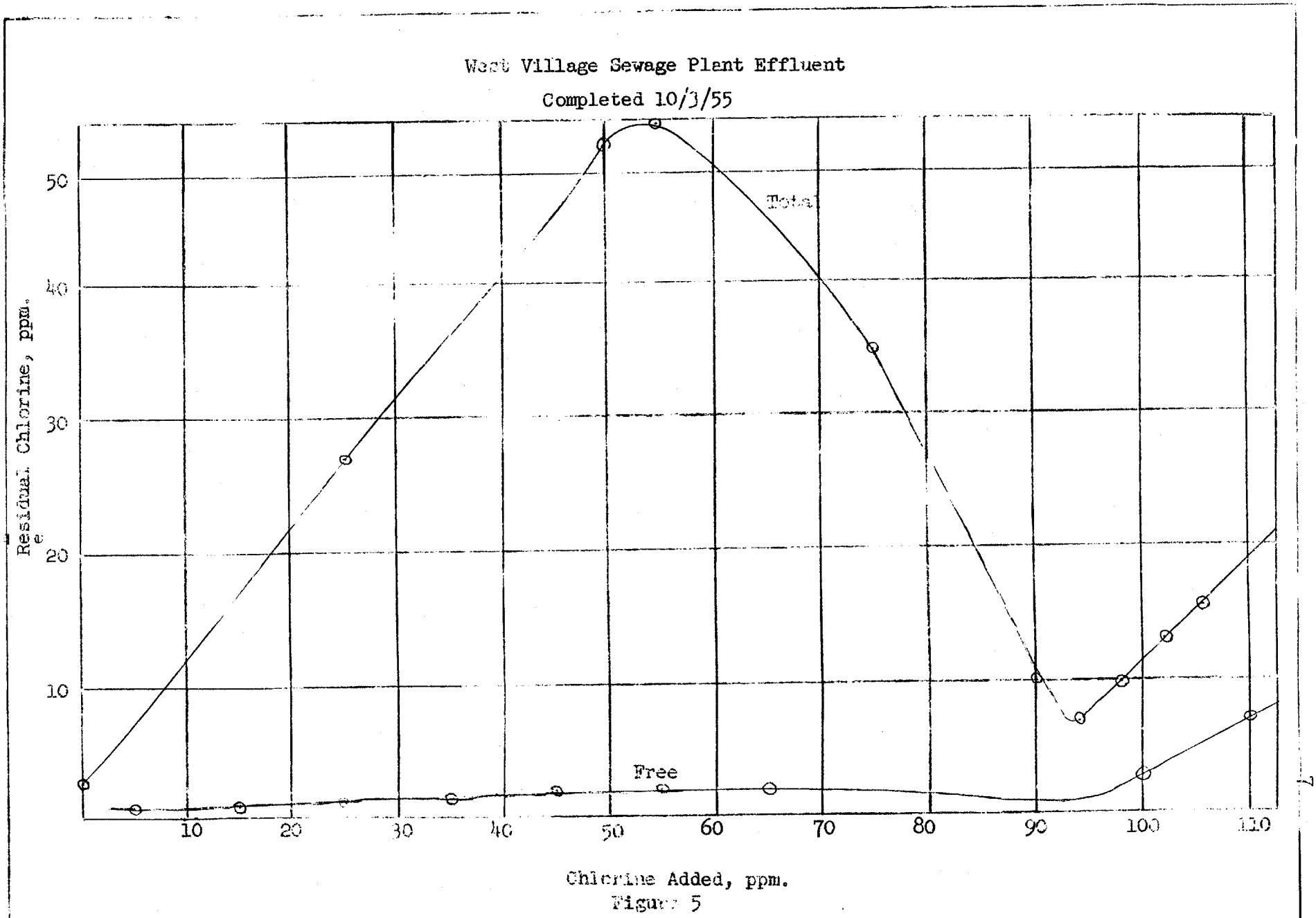


Figure 5

KI-3603

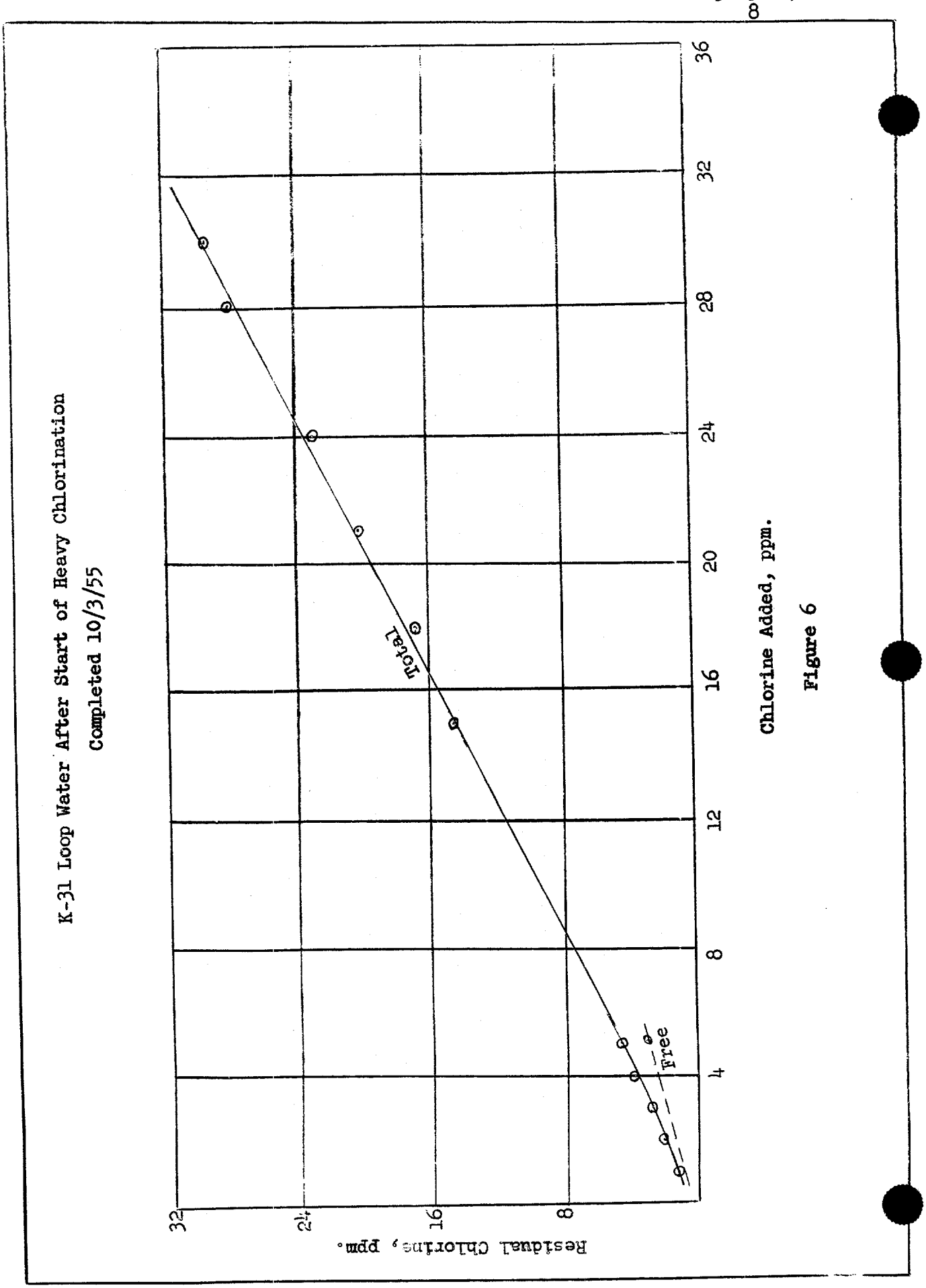

K-31 Loop Water After Start of Heavy Chlorination
Completed 10/3/55
Residual Chlorine, ppm.
32
24
16
8
4
8
12
16
20
24
28
32
36
Total
Free
Chlorine Added, ppm.

Figure 6

MEMORANDUM

To: Files

June 24, 1955

Subject: A Review of the Excessive Alkalinity found in the Poplar Creek Drainage Area of K-25.

On June 3, 1955, the Utilities Department of K-25 notified the Safety and Health Physics Section that during their routine analysis of Poplar Creek water at K-802 it was noted that the P H values of the water indicated significant increases in alkalinity. A review of the findings is shown below.

DATE	HIGH p H VALUE
May 27	7.6
28	8.5
29	8.7
30	8.7
31	8.7
June 1	8.6
2	9.4
3	9.4
4	9.2
5	9.0
6	8.9
7	8.7
8	8.7
9	9.2
10	8.0
11	7.8

The peak of activity seemed to be reached on June 3, 1955, and during the entire day the P H remained well above a value of 9. Although occasionally the p H value will be 8.0 or slightly above for a short period of time, it is extraordinary for the value to remain above normal for such an extended period. As noted in the table, normal water conditions were not resumed until June 11, 1955. On June 3 an effort was made to determine the source of the release of material resulting in the stream changes and the East Fork sampling revealed the following:

LOCATION	p H
East Fork at Turnpike Roane County bridge	10.4
East Fork at Golf Course Road	9.5
East Fork at Jefferson Ave. & Turnpike	11.2
East Fork at Midway Gate near Y-12	11.0

In Poplar Creek the samples are a 3-day continuous sample collected on June 3.

Mouth of East Fork	10.0
Poplar Creek at Clinch River	8.0
Clinch River, 1 mile below plant	8.2

The highest activity was found at the points in the East Fork Branch nearest the Y-12 installation, indicating that this location is the source of the material released to the stream. A meeting was held with the Y-12 Industrial Hygiene representatives at which time they stated they knew of the source of accidental release which had resulted in the stream contamination. It was revealed that at the present time they do not routinely sample the East Fork Branch, and thus are not aware of any change in stream conditions until it is picked up at the K-25 sampling points.

Although during this period of high alkalinity in the stream no ill effect on the animal life, reflected by an abnormal death of fish, was noted, during the latter part of April hundreds of fish were killed in the K-25 Area of Poplar Creek and a check of the p H taken during this period showed that on April 22 the p H went up to 9.4 and remained high during the following day. Since the dead fish were not reported until early May it was not possible to locate the source from which the material was released. The Y-12 Industrial Hygienist indicates that a release of caustic solution occurred during this period of April at Y-12.

A second possible source may have been the acid released in the Clinch River following the cleaning of the Power House boilers which, due to the backflow of the Watts Bar Lake, was carried up Poplar Creek. This possibility seems highly unlikely since p H checks of the Clinch River indicated no significant rise in the p H level.

G. S. Hill

GSH:lwh

No K25RC

MEMO

AVOID ORAL INSTRUCTIONS

Date July 19__

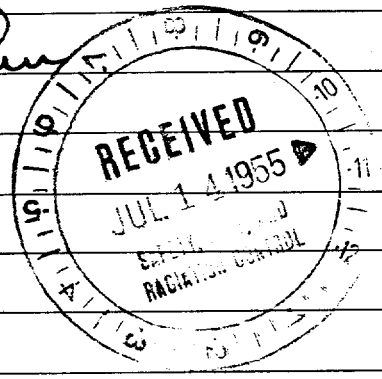
To Dr. H. F. Henry

Re: Attached Report

As reported previously, approximately 4 days elapsed between the time of the actual release and pick-up of the contaminants at the K-25 Pump House.

AFB:msp

A. F. Becher



Signed

WCX-48 (7-50)

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P OAK RIDGE, TENN.

TO LOCATION Mr. A. F. Becher

DATE September 2, 1955

ANSWERING LETTER DATE

ATTENTION

COPY TO

SUBJECT A Review of the Mercury Levels Found in the K-25 Area of Poplar Creek and the Clinch River

During July, 1955, it was noted that the level of mercury in the K-25 Drainage Area of Poplar Creek and the Clinch River had risen sharply above the normal levels expected. Upstream sampling revealed that the material was being released by the Y-12 Installation into the East Fork Branch and thence to Poplar Creek and also was being pumped into a stream leading directly to the Clinch River at a spot upstream from the K-25 Sanitary Water Plant.

Findings

Sampling results showed the following levels:

Date of Sample	Hg (ppb) at the K-25 Clinch River Pump House	Hg (ppb) at the East Fork Mouth at Poplar Creek
July 26	22	560
July 29	32	1,800
August 2	28	200
August 5	2	64
August 9	8	20
August 12	0	16

Other checks made included:

K-25 Drinking Water

Location	Hg Concentration (ppb)
K-1002	0.00
K-1401	0.00
K-832	0.00

A Spot Check of Urine Samples*

No. of Samples	Hg Concentration (mg/l)
2	0.00
2	0.01
4	.02
3	.03
1	.04

Comments

Investigation and inquiries made by the Industrial Hygiene and the Safety and Health Physics Sections did not reveal any established M.A.C. for mercury for rivers or streams.

It is the opinion of the Industrial Hygiene Section that the results from the urine tests indicate no significant mercury ingestion and that at the present stream levels, no particular hazard to personnel is presented.

Spot sampling of the streams and the K-25 Sanitary Water Supply will be continued until the peak levels are established and the hazard adequately evaluated.

G. S. Hill for
Safety and Health Physics

GSH:msp

NoK25RC

*Includes personnel working in plant areas where mercury is handled routinely.

Dr H J Henry -

Stoddard advises no plant problem - literature indicates may be severe in its effect on marine life altho he could not furnish references at this time

C.H.B.

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P OAK RIDGE, TENN.

TO Mr. A. F. Becher
LOCATION

ATTENTION
COPY TO File

DATE November 8, 1955

ANSWERING LETTER DATE

SUBJECT Mercury Contamination - Poplar Creek and Clinch River

Following up on the mercury contamination found in the Poplar Creek and Clinch River systems in the K-25 Area, the water samples taken during September showed the following results:

SAMPLING DATE	LOCATION			
	CW-1	CW-5	CW-6	K-891
September, 1955	East Fork Junction of Poplar Creek	Clinch River Influent of K-25 Sanitary Water	K-25 Sanitary Water	Poplar Creek Process Cooling Water Influent
2	240 ppb	22 ppb	0 ppb	-
6	900 ppb	10 ppb	11 ppb	-
9	-	-	-	-
13	640 ppb	4 ppb	7 ppb	-
16	216 ppb	0 ppb	0 ppb	-
19	-	-	-	0 ppb
20	116 ppb	0 ppb	0 ppb	-
21	-	-	-	16 ppb
23	108 ppb	0 ppb	0 ppb	22 ppb
27	172 ppb	2 ppb	4 ppb	-
30	6 ppb	2 ppb	0 ppb	32 ppb

Samples taken at the Y-12 Weir and other Y-12 water effluents showed the following levels of mercury concentration:

September	ppb Mercury
9	816
12	876
Weekly Composite	992
13	1,536
13	2,500
14	2,200
15	1,900
Weekly Composite	1,900
19	1,500
Weekly Composite	2,000

September	ppb Mercury
Weekly Composite	1,680
20	2,110
21	1,860
23 and 24	1,020
Composite	1,040

Comments

A check with X-10 Health Physics reveals that, at the present time, there is no operation involving the use of significant amounts of mercury and the low levels noted at the sanitary water influent of the Clinch River indicates no significant upstream mercury pollution of the river by this installation. Comparatively large amounts of mercury are apparently released from the Y-12 operations into East Fork Branch with relatively high concentrations noted downstream as far as the Poplar Creek Intersection. In the Poplar Creek, however, the material is diluted considerably as shown by the samples taken at the K-891 Pump House.

G. S. Hill for
Safety and Health Physics

GSH:msp

NoK25EC

W-2

INTER-COMPANY CORRESPONDENCE

(ERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P OAK RIDGE, TENN.

TO Mr. W. L. Richardson
LOCATION K-1001

DATE September 7, 1955

ANSWERING LETTER DATE

SUBJECT Mercury in Sanitary Water

ATTENTION

COPY TO

Although the levels of mercury in our sanitary water have been as high as 30 ppb., there does not anywhere appear to be any information on potential hazards of mercury ingestion, although inhalation is known to be very dangerous. In this, mercury is probably somewhat like uranium where the ratio of amounts that can be safely eaten as compared to that safely inhaled is of the order of 1000.

The Medical Department is aware of the water contamination and has made some clinical checks of employees not exposed to mercury in their normal work; no indication of mercury excretion or other body effect has been found.

H. F. Henry
Safety, Fire, and Radiation Control

HFH:mh

NoK25RC

Dr. Henry: What are the amounts generally found in nature and so-called potable drinking water?
What is the source of mercury in our water?

WLR

WLR: Normally 0; we do not know of any locations where the water level is higher but I'm sure they exist. The danger level is unknown.

Y-12 has been accused of being the source. There is a much higher level in Poplar Creek. However according to Hungerford, X-10 "lost" a good bit of mercury a year ago; thus, they are probably the culprits.

HFH

9/9/55: Let's keep this under scrutiny and advise me when it gets worse or cleared up. Our file should reflect disposition of such matters.

WLR

OK - HFH

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-163 (3-55)

ROUTINE ANALYSES OF ORGDP SANITARY AND PROCESS WATER

SANITARY (Clinch River)

Bacteriological
Turbidity
Color
Residual Chlorine
Alkalinity
Total Hardness

PROCESS (Poplar Creek)

pH
Alkalinity
Total Hardness (Calcium plus Magnesium)
Calcium Hardness
Meta-OrthoPhosphate
Iron
Copper
Sulfate
Turbidity
Suspended Solids
Dissolved Solids
Chromates
Chlorides
Zinc

All Analyses performed weekly.

NBS:nbs
4/18/60